*Our Mission dedicates us to deliver high-quality, innovative, affordable and accessible educational opportunities and services that prepare students for a rapidly changing and diverse global economy*

# Astronomy 201 2013

**Sections & Times:** LM (Fri 9:30 am – 12:45 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 upon request.

**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.

**STUDENT SERVICES**
The Student Services Department assists students in selecting an academic pathway that aligns with their career goals, provides ongoing support through completion and graduation, offers career and transfer assistance, supports student clubs and organizations, and provides support for veterans and students with disabilities.
**http://tinyurl.com/6prvec5**

**DISABILITY BASED SPECIAL NEEDS**
Students who feel they may need an accommodation based on the impact of a disability should contact the Disability Access Center in McKeon Administrative Building. Their phone number is: (773) 907-4725. See link below.

**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: McKeon Administrative Building Room 162, 773-907-4785 or 4790, **http://tinyurl.com/7a8o9ty**..
**Student Success and Leadership Institute (SSLI)**. For students who need various other support services to achieve their educational goals: McKeon Administrative Building Room 162, 773-907-4714.
**http://tinyurl.com/75avz7a**
**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, **http://tinyurl.com/6qdwmc9.**
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: McKeon Administrative Building, 773-907-4725, **http://tinyurl.com/7tkvh88**.

**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.

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- 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.**

| Unit | Topic | 6th Ed. Pages | Video Lessons |
|---|---|---|---|
| 1 | Scientific Method Articles | Online Sources | |
| | Charting the Heavens (Chs. 0.1-2, 0.5 ), | 1-11, 18-23 | A & U-1, 2, 3 |
| | Earth & Its Moon (Ch. 5), | 131-161 | |
| | Time Zones Article | Online Sources | |
| 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<br>U-19 to 22 |
| 4 | Jovian Planets (Ch. 7), Moons, Rings, & Plutoids (Ch. 8) | 192-239 | A-18, 19<br>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),<br>Optional -Telescopes (Ch. 3) | 266-273<br>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<br>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),<br>Optional - Life in the Universe (Ch. 18) | 456-483,<br>484-503 | A-15, U-17, 18<br>A-20, U-26 |

**FINAL EXAM**

# ASTRONOMY 201

## Brief Topical Outline - City Colleges of Chicago

| Topic | Key items to be covered for examinations<br>(See Vocabulary List for complete listing.) |
|---|---|
| **SCIENTIFIC METHOD** | |
| General Principles | Facts, hypotheses, theories, laws, models<br>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<br>Changing position of stars as one travels north or south<br>Disappearance of ships moving away from shore<br>Magellan's voyage<br>High altitude photographs<br>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 | Retrograde motion |
| Geocentric theory | Ptolemy's explanation/model |
| Heliocentric theory | Copernicus' explanation/model |
| Laws of Planetary Motion | Tycho Brahe's observations<br>Kepler's three laws of planetary motion (by name not just by number)<br>Invention of telescope and Galileo's observations<br>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,<br>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);<br>Inverse -reciprocal (1st power), square (2nd power)<br>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 | Stellar parallax, parsec (pc), distance determination problem - Cepheid's period luminosity relation, closest star |
| Brightness | Visual (apparent), absolute, magnitudes = m versus M; distance determination - brightness, Cepheid's period luminosity relation, examples |
| Groupings | |
| By location | Constellations, binary, trinary, etc., globular clusters, galaxies, examples |
| By geometric size | Dwarf, typical solar (Sun, 1 R⊙= Sun's radius), giant, super giant, largest |
| By spectral color | O, B, A, F, G, K, M (O be a fine girl/guy kiss me!) (blue to red) and subdivisions, Sun's type |
| By mass | 1 M⊙= Sun's mass, neutron stars, black holes, examples |
| By activity/detection | Variable, nova, supernova, radio, X-ray. pulsar→ neutron star, examples |
| Life cycle | 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?<br>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?<br>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 |