BOROUGH OF MANHATTAN COMMUNITY COLLEGE

City University of New York

Department of Science

Astronomy: Observations & Models

AST 111
Semester:
Credits: 4

Class Hours: 3
Lab Hours: 2
Instructor Information:
Name:
Email:
Phone:
Office:

Course Description: This course will focus on how astronomers have made observations, and used those observations to construct models of our Universe. Students will collect their own observations and use them to test models of our Universe. This course can be taken instead of AST 110 to satisfy the Science requirement for Liberal Arts students.

Pre-Requisites: MAT 041/051, ENG 088, ESL 062, ACR 094

Articulation & Transfer Credit: This course carries credits that transfer to CUNY senior colleges. AST 111 transfers to York College (equivalent to Astr 140 - 3credits), Hunter College (equivalent to AST 101 - 4credits), Lehman College, College of Staten Island and CityTech.

Student Learning Outcomes and Assessment:

	General Education Learning Outcomes	Measurements
þ□	**Scientific Reasoning-** Students will be able to apply the concepts and methods of the natural sciences.	**Selected questions from the Classroom Test of Scientific Reasoning (pre- & post-test). Homework, labs, class activities, exams/quizzes, final exam.**

Course Student Learning Outcomes	Measurements
1. Students will be able to interpret astronomical observations	**1. Homework, labs, class activities, exams/quizzes, final exam.**
2. Students will be able to propose testable astronomical hypotheses	**2. Homework, labs, class activities, exams/quizzes, final exam.**
3. Students will be able to design experiments (including thought experiments) to test astronomical hypotheses, and interpret their results	**3. Homework, labs, class activities, exams/quizzes, final exam.**

Required Text and Readings:
Title: Astronomy Notes **Author:** Nick Strobel **Publisher:** McGraw-Hill

Other resources: Stellarium is a free program we will use frequently – if you have home computer access, you should download it and practice with it at home: www.stellarium.org. If you do not have home computer access, the computers in the Science Learning Center (N-734) have Stellarium installed, and you should use their open hours to familiarize yourself with it.

Supplementary readings: The Copernican Revolution by Thomas Kuhn

Laboratory: Laboratory instructions and questions will be emailed as separate documents prior to each lab. When necessary, graph paper will also be distributed.

Required equipment: 1) subway map, 2) protractor, 3) inflatable Earth globe, and 4) thumb/flash drive.

Grade Distribution:

Exams, quizzes and classwork: 40%
Labs: 25%
Attendance & participation: 5%
Final exam: 30%
Total: 100%

College Attendance Policy

1.Absences

At BMCC, the maximum number of absences is limited to one more hour than the number of hours a class meets in one week. For example, you may be enrolled in a three-hour class. In that class, you would be allowed 4 hours of absence (not 4 days). In the case of excessive absences, the instructor has the option to lower the grade or assign an F or WU grade.

2. Class Attendance

If you do not attend class at least once in the first three weeks of the course and once in the fourth or fifth weeks, the Office of the Registrar is required to assign a grade of "WU". Attendance in both regular and remedial courses is mandated by policy of the City University of New York. Instructors are required by New York State Law to keep an official record of class attendance.

3. Lateness

Classes begin promptly at the times indicated in the Schedule of Classes. Arrival in classes after the scheduled starting time constitutes a lateness. Latecomers may, at the discretion of the instructor, incur an official absence.

Academic Adjustments for Students with Disabilities

Students with disabilities who require reasonable accommodations or academic adjustments for this course must contact the Office of Services for Students with Disabilities. BMCC is committed to providing equal access to all programs and curricula to all students.

BMCC Policy on Plagiarism and Academic Integrity Statement

Plagiarism is the presentation of someone else's ideas, words or artistic, scientific, or technical work as one's own creation. Using the idea or work of another is permissible only when the original author is identified. Paraphrasing and summarizing, as well as direct quotations, require citations to the original source. Plagiarism may be intentional or unintentional. Lack of dishonest intent does not necessarily absolve a student of responsibility for plagiarism.

Students who are unsure how and when to provide documentation are advised to consult with their instructors. The library has guides designed to help students to appropriately identify a cited work. The full policy can be found on BMCC's website, www.bmcc.cuny.edu. For further information on integrity and behavior, please consult the college bulletin (also available online).

AST 111 Schedule and Outline of Topics
Lecture Topics

Week 1	Introduce concepts of angular measurement. Establish the horizontal coordinate system (HCS) in NYC; define terms: observation, measurement.
Week 2	Examine comprehensive observations of Sun in HCS (covering one year); identify patterns in observations (including: variation in max altitude, consistency of azimuth at max altitude, variation of azimuth at sunrise and sunset, variation in time of max altitude, variation in time of sunrise and sunset).
Week 3	Examine relationship between astronomical events and cultural constructs including the civil calendar, clock time, time zones and daylight savings time; Use models and observations to analyze relationship between clock time and solar time; Justify time zones, daylight savings time
Week 4	Relate HCS to global coordinate system (GCS – latitude and longitude); use observations to construct model for Sun's daily motions; use observations to construct model of Sun's annual motions
Week 5	Use model of Sun's daily and annual motions, plus HCS and GCS, to predict observations for diverse locations on Earth, examine consequences of these predictions (e.g. climate) and compare predictions to worldwide observations (using e.g. weather averages)

Week 6	Use observations of stars in HCS to construct concept of celestial sphere.
Week 7	Use observations of stars in HCS to construct equatorial coordinate system (ECS) model of celestial sphere; Use observations to examine differences between solar time and sidereal time and suggest models to account for difference.
Week 8	Use ECS observations of annual motions of Sun with respect to stars to construct holistic geocentric model (Sun and stars together)
Week 9	Historical/cultural significance of stars/constellations/relationship with sun (mostly western but include brief looks at other world cultures)
Week 10	Use all collected observations to date (Sun and stars) to construct self-consistent heliocentric model
Week 11	Using observations of Mars in ECS, construct model for motion of Mars in geocentric and heliocentric models
Week 12	Discuss historical impact of pre-Copernican physics and theology, 'revolutionary' nature of heliocentric model, historical progression of the Copernican Revolution up to Kepler and Galileo
Week 13	Isaac Newton and the laws of motion; universal gravitation; comparison of the case for the heliocentric and geocentric models
Week 14	Stellar parallax: model predictions and analysis of observations
Week 15	Final Examination

Laboratory Exercises:

Week 1	Measurement of angles; orientation of maps; construction of a "direction finder" as a physical representation of the horizontal coordinate system (HCS).
Week 2	Use HCS to observe Sun from NYC on selected dates over course of one year, using Stellarium; collect altitude and azimuth data and graph in excel.
Week 3	Using direction finder, globe and data collected in previous week as well as model constructed in AST106, predict how a change in observer's location will affect observations of the Sun and test predictions using Stellarium.
Week 4	Predict and test location of the Sun viewed from specific locations on the globe, with focus on annual changes and overall pattern in each location (including poles, equator, tropics and intermediate regions).
Week 5	Collect weather/climate observations (using internet-based weather services) from locations around the globe to test influence of Sun on climate and seasons.

Week 6	Observe daily motions of stars from NYC using HCS; collect and graph data in excel. Predict and test effects of changing observer's location. Discuss use of stars for navigation.
Week 7	Use equatorial coordinate system (ECS) to observe differences between solar and sidereal time. Measure length of solar and sidereal days using instructor provided and student collected data, respectively.
Week 8	Use ECS to observe annual motion of Sun with respect to stars. Measure length of year.
Week 9	Using observations in Stellarium, collect data on cross-cultural differences and similarities regarding constellation forms and names; astronomical significance of zodiac constellations in Western culture; absence of names for particular sky regions, etc.
Week 10	Use physical version of heliocentric and geocentric models to predict observable differences between the two.
Week 11	Observe path of Mars in ECS; construct physical heliocentric and geocentric models.
Week 12	Construction of ellipses vs. circles; observe moons of Jupiter, selected other 'Galilean' observations.
Week 13	Demonstrations of inertia; experiments on falling/orbiting objects using simulations.
Week 14	Stellar parallax: observations
Week 15	Final Examination