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Course Outline for ASTR 30

INTRO TO ASTRONOMY LAB

Effective: Fall 2004

I. CATALOG DESCRIPTION:
ASTR 30 — INTRO TO ASTRONOMY LAB — 1.00 units

Introduction to laboratory principles and techniques in astronomy. Includes: observational techniques such as naked eye, binocular, and telescopic identification of stars, planets, constellations, and deep sky objects; telescope operation and imaging; spectroscopy, motions of the sun, moon and planets. Prerequisite: Astronomy 1 or Astronomy 10 or Astronomy 20 (may be taken concurrently).

1.00 Units Lab

Prerequisite
ASTR 1 - Principles Astro/Astrophysics
or

ASTR 10 - Introduction to Astronomy: The Solar System
or

ASTR 20 - Introduction to Astronomy: Stars and the Universe

Grading Methods:
Letter or P/NP

Discipline:

	MIN
Lab Hours:	54.00
Total Hours:	54.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

Before entering the course a student should be able to:

A. ASTR1
   1. understand specific basic concepts of astronomy utilizing algebra and trigonometry
   2. learn of current areas of astronomical research from reading scientific journals and periodicals.
B. ASTR10
C. ASTR20

IV. MEASURABLE OBJECTIVES:

Upon completion of this course, the student should be able to:

A. write a scientific laboratory report, including the following sections
   1. Title Page
   2. Introduction
   3. Procedure
   4. Results
   5. Discussion and Conclusion;
B. understand distances and sizes in the solar system;
C. understand and determine the angular diameter of an object;
D. identify ten bright stars and ten constellations visible during the semester;
E. locate, using binoculars, and telescopes, at least five celestial objects (such as nebulae, star clusters, and galaxies) not normally visible to the naked eye;
F. describe the difference between, and conditions for, a solar and lunar eclipse;
G. use the concept of parallax to determine the distance to an astronomical object;
H. measure the angular separation of two objects using a sextant or other angular measuring instrument;
I. understand orbital mechanics and the Law of Universal Gravitation;
J. analyze orbital properties of a planet's moons to determine the mass of the planet;
K. measure and calculate the Earth's gravitational field, and explain its consequences for every-day objects;
L. understand and explain such astronomical methods as "blink comparison";
M. explain the Doppler shift and its use in determining periods of rotation of planets;

N. demonstrate an understanding of the fundamentals of digital image processing;
O. measure the wavelength of spectral lines commonly found in stellar spectra;
P. explain how telescopes use lenses and/or mirrors to form images;
Q. align a telescope for proper operation;
R. demonstrate a familiarity with infrared images and their purpose in astronomy;
S. use the method of spectroscopic parallax to determine the distance to remote objects;
T. identify the different types of galaxies by their structure;
U. explain how a CCD camera can image more distant features than a photograph;
V. explain the phenomenon of gravitational lensing;
W. explain how the Doppler shift may be used to create a Hubble Diagram, and estimate the age of the universe;
X. measure the sun's altitude using its shadow;
Y. determine the azimuth and altitude of the sun, moon and stars;
A@. draw a sketch of a star's position on the celestial sphere when given that star's azimuth and altitude or its right ascension and declination;
AA. plot the path of the sun, moon or planets on a star chart;
AB. locate an object on a star chart when given its celestial coordinates.

V. CONTENT:
A. Scaling and the Solar System
B. Naked Eye Observations and Sketches of the Night Sky
C. Telescopic observations of selected objects
D. Angular Diameter, Size and Distance
E. Studying Solar and Lunar Eclipses
F. Exploring Motions of the Heavens Using a Planetarium Program
G. Parallax and Astronomical Distances
H. Gravitation and Orbital Motion, Detecting Extra-Solar Planets
I. The Moons of Jupiter
J. Measuring the Earth's Gravitational Field and Mass
K. Finding an Eclipsing Binary Star
L. The Rotation of Mercury Measured by Doppler Radar
M. Tracking Sunspots
N. Spectroscopy in Astronomy: Emission Spectra
O. Lenses and Telescopes
P. Infrared Images of the Orion Nebula
Q. An Introduction to Digital Imaging: Surfaces of Solar-System Objects
R. Photoelectric Photometry of Star Clusters
S. Structure of Galaxies
T. Clusters of Galaxies
U. Gravitational lensing
V. The Expansion of the Universe

VI. METHODS OF INSTRUCTION:
A. **Lab** - Three-hour laboratory session per week
B. **Demonstration** - Instructor demonstration Student participation in demonstrations
C. Student experimentation

VII. TYPICAL ASSIGNMENTS:
A. Laboratory Exercise 2. Computer Simulation 3. Observational Activity 4. Field Trip

VIII. EVALUATION:
A. **Methods**

1. Lab Activities

B. **Frequency**

1. Students are required to show up for every laboratory meeting.
2. Students are required to participate at each laboratory meeting.
3. In general, laboratory reports will be handed in each week. Some laboratory exercises will cover two class meetings.

IX. TYPICAL TEXTS:

X. OTHER MATERIALS REQUIRED OF STUDENTS:
A. red observing light
B. Computer access, through purchase of a Computer Use Card at LPC, or access to a personal computer at home or work with an Internet connection.
C. Flashlight
D. durable star chart,
E. warm clothing strongly recommended.