PHS 207-01 Astronomy -- Salem State University --- Spring 2013

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Classroom MH 542**:**  Monday 6 – 8:30 pm

Final Exam (in MH542) : Monday, May 6, 2013 6 – 8:30 pm

Office(MH 419, Physics Prep Room. If the door is not open, just knock)**:**

Monday 4 – 5:30 pm or by appointment

Course Description:

Introduction to modern astronomy topics for the enthusiastic novice are: the life cycles of stars from nebulae to novae and dwarfs; the structure of the galaxies and universes; current theories of cosmology; the origin and the evolution of our solar system; the search for extra-solar planets; the search of extraterrestrial life, and space travel; techniques and technologies for making for making these discoveries; and identification of stars, constellations, and Messier objects with periodic visual observations in the telescope in Collins Observatory and through binoculars.

**Course Goals: “What do we know?** **How do we know? What are the present research fields?”** These three astronomy questions form the basis of our gradually more intensive study of the universe.

In WHAT we examine what we can see in the sky first without optical aids and consider the atmospherically, geographically, and seasonally limitations to develop a map of our night sky through prescribed constellations. We also learn the definitions and applications of astronomical terms before delving into the specific physics and chemistry of the universe and evolutionary theories of the universe.

In HOW we consider how what we know occurs through study and application of Newton’s laws, gravity, fission, fusion, different forms of radiation that we can detect, special and general relativity, and the Big Bang theory. Thus scientists and amateur astronomers have assumed and have no evidence to contract the assumption that these same theories and laws apply through the universe.

In RESEARCH by analyzing websites and reading and discussing journal articles by scientists and amateur astronomers, we learn about the universe, Earth, and our solar system through increasingly more sensitive and sophisticated instruments. Thus we will be able to study websites and scholarly articles with a general understanding of terms and figure out unfamiliar ones.

**Course Objectives:**

# The student will be assessed through class discussion, home work, quizzes, exams, and observatory observations to: (**The student will be able to do are noted in this font**.)

# --- identify specific constellations to locate portions of our night sky **(look into a clear night sky and in few minutes determine the season and roughly her/his present location and the time and know where to locate phenomenon described in the media and scientific journals).**

--- demonstrate a knowledge of how an optical, a radio, other frequency, ground and orbiting telescopes work including the characteristics (advantages and disadvantages) and the advances made using digitized data and computer analysis **(understand the contribution of the telescope and other instruments to our accepted understanding of the universe and explain it to a curious inquirer).**

--- describe how the Sun produces energy and what kinds of energy, the life cycles of stars (especially our Sun), the formation and properties of stars, their radiation properties and classification **(know the dangers of looking into the sun especially during an eclipse, differentiate between fission and fusion energy, with a spectrometer identify chemical elements of a star and a planet and its distance from us).**

--- solve simplified astronomical problems with Newton’s laws, gravity, fission and fusion reactions, special and general relativity using high school arithmetic, geometric, and algebraic skills **(to develop a plausible explanation for an observation of the night sky).**

--- describe our understanding of galaxies, clusters, nebulae, novae, supernovae, and black holes, and dwarfs, their formation, classification, and their apparent motion, and the structure of the Milky Way (**describe the Big Bang theory and effects of gravity and fusion on the development of the Universe**)

--- explain the apparent motion in our Solar System, the Earth, Sun, Moon, and Planets (**understand planetary and orbital motion and the forces and the complexity involved to explain in general terms to a curious but unknowledgeable listener)**

--- describe the formation of asteroids, meteors, comets, and planets **(relate that to the evolution of the Earth and its life forms)**

--- explore satellites, human space travel and life on other planets **(understand the requirements for life as we know it and the limitations and possibilities of human space travel).**

Course Requirements: Mathematical (in part from University of Oregon Astronomy 101 website): :

In this course will be working with large numbers and simple linear and inverse square equations. Any problems may require you to do simple algebra. You need NOT be proficient, but you need to be familiar with the skills listed below. Most state high school graduation standards require proficiency in:

* apply arithmetic operations with fractions and integers with a calculator
* use exponents and scientific notation
* use the correct order of arithmetic operations
* correctly perform addition, subtraction, multiplication and division that includes variables
* understand exponents, roots and their properties solve linear equations
* solve simple problems through the use of geometric construction
* are able to convert between decimal approximations and fractions
* understand relative magnitude
* know how to make and use estimations
* know the definition of a mathematical expression (a statement using numbers and symbols to represent mathematical ideas and real world situations)
* understand the appropriate uses of such symbols (e.g., equal signs, parentheses and superscript)
* understand and use data represented in various ways (e.g., charts, tables, plots and graphs)

**Methods of Instruction:**

The course is taught with informal discussion/presentations by the instructor and interactive.. Presentations will incorporate websites, PowerPoint, CMAP, GoToMeeting, and other web based tools.

**To a successful student you need to complete the daily reading assignment BEFORE class to participate in class dialogue and correctly complete daily quizzes that may begin or during class.**

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**Methods of Evaluation:** Grades are determined by a total of 100 points and follow the Salem State grading scale.

Exam 1 15

Exam 2 15

Exam 3 15

Final Exam 20

Quizzes on homework\*, reading material, and class discussions 20

Collins Observatory Observations 15

Weather permitting we will conclude all classes with the last 30 minutes in the Collins Observatory. With inclement weather we will work with Stellariumtm in the class. There will be one afternoon observation of the Sun for approximately one hour. That date to be determined.

There are likely to be daily class quizzes. The three lowest quiz scores will be dropped.

\*Homework (will be assigned, discussed, in some instances collected and graded as a quiz, and incorporated into the quiz score.)

CONDITIONS: If a student scores poorly on Exam 1, Exam 2, or Exam 3 but has an 85% or better class attendance and participation AND has an 80% or better score on the quizzes, the Final Exam can replace the score for one of the Exams. (The three lowest quiz scores will be dropped in determining the 80% for condition of the replacing an earlier exam grade with the final exam one.) In other words, if a student is performing well in the rest of the course but not so well on an earlier exam(s), that student’s final exam grade can be 35 points of the grade rather than 15 points.

All EXAMS and QUIZZES are NOT open book but a student is allowed one (8 ½” x 11”) sheet of paper for notes on both sides. Calculators are acceptable, but sharing a calculator is not.

To receive any credit for an answer to an exam or quiz question, a sufficient explanation, written and/or equations, must be shown to determine the your answer.

A Textbook, Numerous websites & Web-based Interactives

**Primary text for vocabulary and concepts:**

**Astronomy : a self-teaching guide** by Dinah L. Moché 7th ed. John Wiley & Sons 2009

**Class Attendance and Schedule:**

Class attendance will be noted. No classes will be repeated.

The schedule may change as the course progressed.

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| --- | --- | --- | --- |
| Class/Date | Lesson/Topic | Activities/  Descriptions | Assignments/  Objectives |
|  | I. Starry Sky - Basics of Celestial Motion & Star Identification |  | Moché Chapter 1 |
| #01 Mon Jan 14 | 1. Celestial Sphere | Celestial sphere   1. NAAP simulations & animations   B. NAAP labs: | How to find your way around the sky  Declination  Ascension |
|  | B.Constellations & Stellariumtm  (Virtual sky on your PC) | Brightest stars (in each season) & Constellations are like road markers | What we can & can’t see. |
|  | C.Sloan Digital Sky Survey/Skyserver or  SDSS/SS | Accumulation on the Web of world-world academic and amateur investigations and results |  |
| #02 Mon Jan 28 | D.Enhanced Sky Sensing |  | Moché Chapter 2 |
|  | 1. Telescopes   How we see what is in the sky. | NAAP  Telescope simulator | Telescopes of different types & focal arrangements  Powers of a telescope  Light gathering power  Resolving power  Spectrographs |
|  | 1. Satellites |  | Gamma, X-ray, IR, UV, & Optical |
| #03 Mon  Feb 4 | D.The Sun |  | Moché Chapter 4 |
|  | 1. Features  (it is our first example of a star and shows how one typical star functions.) | I. Spectra generated by  Nuclear fusion  II. Motions of the Sun   1. Overview   1. Ecliptic  2. Seasons  3. Hours of daylight  a. Solar  b. Sidereal day  B. NAAP simulator | NAAP Sun & Solar energy  Nuclear energy  Thermal transport  Hydrostatic equilibrium  Sunspots  Differential rotation  Charged particles in magnetic fields |
|  | 2. Monitoring | Sun Strata  Photosphere  Chromosphere |  |
| #04 Mon  Feb 11 | 1st Exam | Basic Celestial Motion, Our viewing, the Sun, & Star Identification | Moché ch. 1, 2, & 4 & class presentations |
| #05 Mon Feb 25 | **II. Stars** |  | Moché ch. 3 |
|  | A.Luminosity & Spectra | Star characteristics/signatures in luminosity and spectra  Atoms, Spectra, & Stellar Spectroscopy (from UR -University of Rochester, NY) | NAAP  EM Module  Spectrum Explorer  Three Views of Spectrum  Blackbody curves & UBV filters |
|  | B. Determining the distance to stars | Measuring distance  with parallax  Arc-minute  Arc-second  Parsec  Stellar Parallax fm U of R  Cephid  Variable star photometry | Doppler shift & proper motion |
| #6 Mon  Mar 4 | Stellar Evolution |  | Moché ch. 5 |
|  | 1. Birth of stars | Hertzsprung-Russell Diagram  NAAP H-R Diagram Explorer  Star creating sequence  1st generation star  2nd generation star  3rd generation star |  |
|  | 1. Nebulae |  |  |
|  | 1. Death of stars | **Death**  Neutron stars,  Novae, black holes | H-R evolution tracks: core stages, planetary nebulae, supernovae, end states of stars. |
| #7 Mon  Mar 18 | 2nd Exam | Stars & Stellar Evolution as observe it in spectra, luminosity, distance, & lifetime (birth through death) | Moché ch. 3 & 5 |
|  | **III. Galaxies, the Universe, & Cosmology** |  |  |
| #8 Mon  Mar 25 | 1. Our Milky Way | **Milky Way**  Shape, Size, composition  Star nursery, Black holes, & WM rotational velocity | Moché ch.6  Characteristics of halo and disks, rotation curves,spiral arms, & variable stars |
|  | 1. Other Galaxies | Types of galaxies and their characteristics, the Hubble Tuning Fork Diagram, galactic evolution, active galaxies, & quasars |  |
| #9 Mon  Apr 01 | 1. The Universe | Ballooning universe | Moché ch. 7 |
|  | 1. Cosmology | The Big Bang, Characteristics of the expansion, & the Hubble Constant |  |
| #10 Mon  Apr 8 | 3nd Exam | Galaxies, the Universe, & Cosmology |  |
|  | **IV. Solar System** |  |  |
| #11 Mon  Apr 22 | 1. Planetary motion and evolution | Planet formation temperature plot  Solar system properties  Planetary orbit simulation.  Kepler’s Laws | Moché ch. 8  Planetary configurations |
|  | 1. Terrestrial Planets | Orbits of planets, characteristics ot terrestrial and jovian ones, | Moché ch. 9 Developing a planet characteristic table  Periods of rotation & revolution, evolution, retention of planetary atmospheres, & cratering rate |
|  | 1. Gaseous or Jovian Planets | Gaseous  “frost line” | Class Action  Jovian planets & their moons |
|  | 1. Our Moon | NAAP  Lunar phase simulations  Lunar phase vocabulary  Moon phases & the Horizon | ClassAction  Lunar Phases, eclipses, synchronous rotation, and tides |
|  | 1. Comets, Meteors, & Asteroids – Other bodies orbiting our solar system | NAAP  Meteors, meteorites, asteroids, comets, Kuiper Belt | ClassAction |
| #12 Mon  Apr 29 | **V. Life in Other Worlds** | Life requirements & searching for exoplanets | NAAP Circumstellar Habitable Zone simulations.  Exsolar planets |
|  | **VI. Space Travel** | Less than 60 years |  |
| #13 Mon  May 6 | **FINAL EXAM** | Exam will be on the whole course with emphasis on the final four units: Solar System, Life, & Space Travel |  |

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Salem State College is committed to providing equal access to the educational experience for all students in compliance with Section 504 of The Rehabilitation Act and The Americans with Disabilities Act and to providing all reasonable academic accommodations, aids and adjustments. Any student who has a documented disability requiring an accommodation, aid or adjustment should speak with the instructor immediately. Students with Disabilities who have not previously done so should provide documentation to and schedule an appointment with the Office for Students with Disabilities and obtain appropriate services.

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