

**William Paterson University**  
**Department of Physics**

**General Astronomy - PHYS 1700**  
**(4 Credits)**

**COURSE SYLLABUS**

Winter Session: December 26, 2015 to January 11, 2016

**Instructor:** Zohar Ris  
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**COURSE OBJECTIVE:**

This online course is an introduction to astronomy concepts of the Earth, the solar system, and the universe. Historical developments in astronomy from ancient mythology to modern science will be covered. Topics include: History of Astronomy, Gravity and Light, The Solar System, The Earth-Moon System, The Formation and Evolution of Stars, Galaxies, and Frontiers of Exploration.

**LEARNING OBJECTIVES:**

In General Astronomy, the specific learning objectives to achieve the goals of the course are:

- To investigate the basic facts, principles, theories, and methods of modern science as practiced in astronomy.
- To learn the basic observable phenomena of astronomy, and how these have had both practical applications and played a key role in advancing our understanding of the Universe.
- To learn important events in the history of astronomy, particularly the development of our understanding of the nature of the Universe and the discovery of the physical laws that govern its motions, formation history, and evolution.
- To explain the role of modern technology in the investigation of astronomical phenomena, and the crucial role played by technological advances in extending our knowledge of origin and behavior of the Universe.

- To explore how discoveries in astronomy have implications for how we have come to view our place in the Universe, and by comparing the Earth to other planets in our Solar System provide a physical framework for understanding the possible impacts of our activities on the Earth.

## **THIS COURSE IS TAUGHT ENTIRELY ON-LINE**

**Every student at William Paterson has a student university e-mail address. Your university e-mail address is attached to Blackboard, and that is the one that will be used to contact you about assignments and other matters related to the course. You must be familiar with attaching files and accessing internet sites.**

**To take this course you MUST know how to use Blackboard, Microsoft WORD, EXCEL, and POWERPOINT**

### **TEXT AND SOFTWARE:**

Astronomy: A Beginner's Guide to the Universe SEVENTH Edition  
(Sixth edition is also acceptable this semester – PLEASE NOTE: If the page number deviates from the seventh edition it will be so noted).

By Eric Chaisson and Steve McMillan

Texts for this course are available for purchase online or in person at the William Paterson University bookstore

### **WPU Blackboard Access**

Link: <http://bb.wpunj.edu>

Support: <http://www.wpunj.edu/helpdesk/>

### **Lab sheets to be distributed online**

#### **Required Software:**

\*Microsoft WORD or other current word processor

\*Stellarium (Free program downloaded from [www.stellarium.org](http://www.stellarium.org)) used for Home Laboratory

Assignments. <http://www.stellarium.org/>

#### **For direct download links:**

##### **Windows Download:**

<http://sourceforge.net/projects/stellarium/files/Stellarium-win32/0.13.1/stellarium-0.13.1-win32.exe/download>

##### **Mac/OS X (10.6 - Intel) Download:**

<http://sourceforge.net/projects/stellarium/files/Stellarium-MacOSX/0.13.1/Stellarium-0.13.1.dmg/download>

### **Stellarium Manual Download:**

[http://sourceforge.net/projects/stellarium/files/Stellarium-user-guide/0.10.2-1/stellarium\\_user\\_guide-0.10.2-1.pdf/download](http://sourceforge.net/projects/stellarium/files/Stellarium-user-guide/0.10.2-1/stellarium_user_guide-0.10.2-1.pdf/download)

### **GRADING:**

Your grade will be determined by the following work:

Mid-term Exam	25%
Assignments	20%
Final Exam	30%
Lab Work	25%

### **Academic Dishonesty**

Submitting assessment material for this course which does not represent your original effort is a serious form of academic dishonesty. Having a third party (eg. tutor, friend, etc) complete any of the assessments is in violation of the University regulations on academic dishonesty

(<http://ww2.wpunj.edu/admroot/adminsrv/hr/facultyhandbook2000/studentcodeofconduct.htm>).

### **NOTE:**

**This is an intensive survey course, and will cover the bulk of our textbook in a very short period of time. There are daily assignments and labs which MUST BE turned in on time for grading.**

### **Standard Evaluation:**

The following grade scale will be used to assign final grades for this course:

Cumulative Final Grade	Letter Grade
95-100	A
90-94	A-
87-89	B+
84-86	B
80-83	B-
76-79	C+
72-75	C
68-71	C-
64-67	D+
55-63	D
<55	F

## **LATE SUBMISSION, MISSED EXAMS POLICY**

As this is a VERY short semester:

1. You will be deducted 25% for each day late in submitting assignments (up to 4 days)
2. You may take a missed exam with a penalty of 25% up to 24 hours after the exam was originally scheduled.

**MAKE SURE TO KNOW WHEN ASSIGNMENTS AND EXAMS ARE POSTED AND DUE TO AVOID ANY PENALTY**

## **IMPORTANT COURSE DATES**

December 26	Winter Session begins (all courses will be offered on-line)
December 31-January 2	<b>MID TERM</b> Last date for academic withdrawal (no refund). Notification of student intent to withdraw must be made by January 6 via e-mail to: wintersession@wpunj.edu
January 9-11	Final Exam Period / On-line Winter Session ends (1/11)

## **COUSE TOPICS**

### **1. THE COPERNICAN REVOLUTION – THE BIRTH OF MODERN SCIENCE**

December 26

This module traces the development of astronomical thought from the geocentric view of the universe to modern astronomy covering the contributions made by Copernicus, Tycho Brahe, Kepler, Galileo, and Newton. Other topics include: The significance of Newton's laws of Motion and Universal Law of Gravitation; our view of the sky from the planet Earth and the apparent motion of celestial objects; the diurnal paths of stars; and the apparent annual motion of the sun and planets.

TEXT: Page 25 to 49. Chapter 1

ASSIGNMENT: Page 40 Review and Discussion (R&D) Questions: 1, 3, 4, 7, 10

LAB #1: Introduction to Stellarium and Observing the Heavens

## **2. LIGHT AND MATTER – THE INNER WORKINGS OF THE COSMOS**

December 27

The module covers the basic properties of light and matter that enables astronomers to understand so much about the universe. Other topics include: Duality of light, spectral emissions, Models of the atom and the Doppler effect.

TEXT: Chapter 2 Pages 43-66

ASSIGNMENT: Page 66 Review and Discussion Questions(R&D): 4, 5, 7, 10, 12

Lab #1: Introduction to Stellarium and Observing the Heavens

## **3. TELESCOPES – THE TOOLS OF ASTRONOMY**

December 28

The module covers the tools used by astronomers since the age of Galileo – The telescopes. With today's technology, telescopes are able to view the universe in much of the electromagnetic spectrum. Other topics include: types of optical telescopes, the Hubble space telescope, resolving power, and atmospheric effects, radio astronomy and space based telescopes.

TEXT: Chapters 3 Pages 69-96

ASSIGNMENT: Page 96 Review and Discussion Questions (R&D): 1, 4, 7, 9, 12

Lab #2: Using Stellarium to map the heavens

## **4. THE MOON**

December 29

The module covers study of the Moon as viewed from Earth and concludes with what we know about our nearest neighbor in space from manned and unmanned lunar missions: Among the topics covered are: aspects of the Moon; lunar phases; sidereal and synodic months; lunar tides; solar and lunar eclipses; physical properties of the Moon; lunar surface features; the geology of the Moon; origin of the Moon; unmanned and manned expeditions to the Moon.

TEXT: Chapter 5 (Section 5.6, 5.7 and 5.8) Pages 151-159

ASSIGNMENT: Page 160 Review and Discussion Questions(R&D): 11, 12, 13, 15

LAB #3: Kepler's Laws of Motion: Kepler's 3<sup>rd</sup> Law

## **5. EXPLORING THE SOLAR SYSTEM - THE TERRESTRIAL PLANETS**

December 30

The module covers the study of the four innermost planets of the Solar System: Mercury, Venus, Earth, and Mars. Among the topics covered are: physical properties of the terrestrial planets; classifying planets; and spacecraft missions to the inner planets.

TEXT: Chapter 5. (Sections 5.1 – 5.5) ,Pages 135-151 and Chapter 6, Pages 163-190

ASSIGNMENT: Chapter 5 R&D questions pg.160: 3, 4

Chapter 6 R&D questions pg.190(**6<sup>th</sup> Edition 190-191**):: 4, 6, 9, 13, 14

LAB #4: Using Stellarium to learn about the seasons

## **6. EXPLORING THE SOLAR SYSTEM – THE JOVIAN PLANETS**

December 31

The module covers the study of inner gas giants of the Solar System, Jupiter and Saturn. Among other topics covered are: physical properties of the Jovian planets; and spacecraft missions to the outer Solar System planets. The moon systems of Jupiter and Saturn; and planetary ring systems. Other topics include the study of the outer gas giants of the Solar System, Uranus and Neptune; the physical properties of the minor Jovian planets; and spacecraft missions to the outer regions of the Solar System; and ring systems.

TEXT: Chapter 7 Pages 193-212

ASSIGNMENT: R&D questions pg. 214 (**pg.213 6<sup>th</sup> edition**): 3, 5, 7, 8, 12, 13

LAB #5: Understanding Eclipses and the Moon using Stellarium

## **7. SOLAR SYSTEM VAGABONDS – COMETS, MOONS, PLUTIODS, RINGS, AND DEBRIS**

January 1

The module covers study of objects, including comets, that were left over from the origin of the Solar System. Among the topics covered: meteors and asteroids; the mystery of Pluto; trans-Neptunian and Kuiper belt objects;

TEXT: Chapter 4 (Section 4.1, 4.2) pg.101-118 and Chapter 8, pg.217-239(**pg.215-237 6<sup>th</sup> edition**)

ASSIGNMENT: Chapter 4 R&D questions pg. 132: 2, 4, 7

Chapter 8 R&D questions pg. 240 (**pg.238 6<sup>th</sup> edition**): 2, 5, 9, 13

LAB #6: Understanding the planets and their motions using Stellarium

## **8. ORIGIN OF THE SOLAR SYSTEM AND EXOPLANETS**

January 2

The module covers theories for the formation of the Solar System, and methods used in detecting other planetary systems.

TEXT: Chapter 4 (Section 4.3 and 4.4) pg.118-131

ASSIGNMENT: R&D questions pg. 132: 9, 10, 13, 14, 15

LAB: No Lab (Pre Mid-term)

### **MID-TERM EXAM January 2 - January 4, 2016**

## **9. THE SUN: OUR PARENT STAR**

January 4

The module covers structure of the Sun and its effect on the planet Earth. Among the topics covered: The origin of the Sun; What makes the sun shine? The sun's visible surface; and sunspots.

TEXT: Chapter 9 pg. 245-265 (**6<sup>th</sup> edition pg. 244-264**)

ASSIGNMENT: R&D questions pg. 266 (**pg.264 6<sup>th</sup> edition**): 1, 5, 7, 8, 12, 15

LAB #7: Learning about star magnitudes and distances using Stellarium

## **10. MEASURING THE STARS: GIANTS, DWARVES, AND THE MAIN SEQUENCE**

January 5

The module covers the distances and motion of stars; stellar parallax and proper motions; stellar magnitudes; spectral classification; color-temperature relationships; stellar masses and binary stars. HR diagram

TEXT: Chapter 10 pg. 269-289 (pg. 267-288 6<sup>th</sup> edition)

ASSIGNMENT: R&D questions pg. 290 (pg.288 6<sup>th</sup> edition): 1, 4, 5, 7, 9, 12, 13

LAB #8: Using Stellarium to understand star color and B-V index

## **11. STELLAR EVOLUTION: THE LIVES AND DEATHS OF STARS**

January 6

The module covers the lives of stars from birth to death. Among the topics covered: the life cycles of Sun-like stars, and massive stars becoming giant and super giant stars; dwarf and neutron stars; pulsars; nova and super nova explosions; mysterious black holes in space.

TEXT: Chapter 12 pg. 321-345(6<sup>th</sup> edition 319-344) and Chapter 13 pg. 349-373(pg. 347-372 6<sup>th</sup> edition)

ASSIGNMENT: Chapter 12 R&D questions pg. 346(6<sup>th</sup> edition pg344): 2, 7, 9, 12

Chapter 13 R&D questions pg. 374(6<sup>th</sup> edition pg. 372): 2, 7, 9, 12

LAB #9: Using Stellarium to understand the H-R diagram

## **12. THE MILKY WAY GALAXY – A SPIRAL IN SPACE**

January 7

The module covers the structural features of the Milky Way Galaxy. Other topics include: rotation of the Galaxy; stellar populations; and radio view of our home galaxy; and nebulae and star clusters.

TEXT: Chapter 14 pg. 379-401 (pg.377-400 6<sup>th</sup> edition)

ASSIGNMENT: Chapter 14 R&D questions pg. 402 (6<sup>th</sup> edition pg. 400-401): 2, 5, 7, 8, 9, 13

LAB #10: Red Giants on the HR Diagram and Stellarium

## **13. NOTE\*\* : THERE ARE TWO ASSIGNMENTS ON THIS DAY THE GALAXIES: OTHER ISLAND UNIVERSES**

January 8

The module covers the structure of other galaxies in the universe. Other topics include: classification of galaxies; distribution of galactic systems; the local group; clusters of galaxies; Quasars; and active and radio galaxies; and “Dark Matter.”



TEXT: Chapter 15 pg. 405-429 (pg. 403-428 **6<sup>th</sup> edition**) and Chapter 16 pg.432-455 (**6<sup>th</sup> edition** pg. 431-453)

ASSIGNMENT: Chapter 15 R&D questions pg. 429 (**6<sup>th</sup> edition** p.428): 10, 11, 13  
Chapter 8 R&D questions pg. 456 (**6<sup>th</sup> edition** p.454): 9, 14, 15

### **COSMOLOGY: THE ORIGIN AND EVOLUTION OF THE UNIVERSE.**

The module covers the theories for the origin of the universe. Other topics include: evolution of galaxies; the cosmological principle; the age of the universe; the red-shift; Big Bang Theory; dark energy; space and time; astrobiology, life in the universe.

TEXT: Chapter 17 pg. 458-482 and Chapter 18 pg. 485-501

ASSIGNMENT: Chapter 17 R&D questions pg. 482: 6, 13, 14

Chapter 18 R&D questions pg. 501-502: 5, 9, 14

LAB: NO LAB (PRE-FINAL)

### **FINAL EXAM January 9-11, 2016**

Please check the WPU Blackboard on a regular basis for announcements, additional assignments, and podcasts postings.