Bergen Community College
Division of Mathematics, Science and Technology
Department of Physical Sciences

Master Course Syllabus
PHY 111 - Astronomy

1.
Semester and year:
Course Number:
Meeting Times and Locations:

Instructor:
Office Location:
Phone:
Office Hours:
Email Address:

2. **COURSE TITLE:** PHY 111 - ASTRONOMY.

3. **PREREQUISITES:** NONE.

4. **COURSE DESCRIPTION:** ASTRONOMY is a survey of the universe. Light, astronomical instruments, and the historical development of Astronomy are topics to be studied to initiate a tour of the heavens, which include the Earth as a planet, the Moon, the Solar System, stars, galaxies, quasars, black holes, and scientific theories of the creation of the universe. The possibility of life elsewhere is discussed throughout. Labs supplement the course material and include an evening at our observatory. **This is a General Education Course.**
(3 Lecture Contact Hours, 3 Laboratory Contact Hours, 4 Credits)

5. **TEXTBOOKS:**
Opstbaum, Roger, 1999: Astronomy Notes, 7th ed, Kendall/Hunt, Dubuque, IA, 100 pp.

6. **LABORATORY MANUAL:**
A. Labs 1 and 12 as part of Astronomy Notes.
B. LSW packet (obtainable from the bookstore; xeroxed copies unacceptable).

7. **STUDENT LEARNING OBJECTIVES (OUTCOMES)**
As a result of meeting the requirements of this course, the student will be able to:
1. Demonstrate a fundamental knowledge of the structure, dimensions, and contents of the universe, as well as its evolution.
2. Consider the prospects for life elsewhere and its origins as a natural consequence of the universe's evolution.
3. Develop a vocabulary of astronomical terms.
4. Explain the wave nature and particle nature of light.
5. Understand how the intensity of light varies inversely with distance squared.
6. Understand the interaction of radiation with matter on the atomic scale.
7. Understand the tools of the Astronomer – telescopes, what spectra are for, CCD photography, etc.
8. Understand the information available at non-visible wavelengths of the electromagnetic spectrum and the instruments that obtain this information.
9. Know what missions we have sent within the solar system.
10. See the historical evolution of Astronomical thought from geocentric to heliocentric theory as well as other Astronomical achievements of a historical nature.

11. Understand Kepler's Laws of orbital motion.
12. Understand Newton's Laws of motion.
13. Understand Newton's Law of Gravity.
14. Look at our Earth as a planet.
15. Understand how plate tectonics on a planet is a prerequisite to life as we know it.
16. Understand the uniqueness of how Oxygen is produced in our atmosphere and the importance of that considering our dependence on it.
17. Understand Ozone depletion in our atmosphere from an Astronomical perspective.
18. Understand the cause of global warming from an Astronomical perspective.
19. Understand the importance of a magnetic field around a planet for life as we know it.
20. Understand rotational, revolutional, and precessional motions of celestial objects.
21. Understand the causes and consequences of seasons.
22. Understand how time is reckoned on Earth, and calendars.
23. Know about our Moon and its origin.
24. Know how eclipses occur.
25. Know how tides occur.
26. Know about the planets of our and other solar systems.
27. Understand how Venus' runaway greenhouse works and why this didn't happen on Earth historically but could still happen through our continued usage of the fossil fuels.
28. Analyze why the Viking missions might have found life on Mars.
29. Understand the view of why it might be Jupiter, not Mars, that might give us the best chance for finding life elsewhere in the solar system.
30. Know about the moons of other planets in our solar system.
31. Know about asteroids, comets, meteoroids, and Kuiper belt objects in our solar system, as well as the Oort comet cloud.
32. Understand how our Sun and other stars generate energy.
33. Understand the nature of sunspots and other features of the Sun.
34. Understand Astronomical causes of Ice Ages on the Earth.
35. Understand the way stars go through a life cycle.
36. Know about white dwarfs, Type I supernovae, Type II supernovae and how these death modes eventually give way to the next generation of stars.
37. Understand how Type II supernova explosions can evolve into pulsars/neutron stars and stellar black holes.
38. Know about galaxies, radio galaxies, Seyfert galaxies, and quasars.
39. Understand the evidence for an expanding universe.
40. Understand the standard theories of the origin of the universe.
41. Understand the standard theories of the origin of the solar system.
42. Know a highlighted chronology of the evolution of life on the Earth.
43. Know how to determine the likelihood of life elsewhere in our Milky Way galaxy.
44. Acquire sufficient Astronomical knowledge to think about our place in the vast design of things.

8. ASSESSMENT:

Assessment of these objectives will be based on students performances on tests and, where appropriate, on their laboratory reports.

9. SPECIAL NOTES:

A. Homework.
If possible, text pages appropriate to a particular class meeting (see #13, Syllabus, below) should be read before that class.

B. The Way the Course Will Be Run.
This is a packet of lecture notes. Lecture notes are on lecture topics. Notes will not include discussion topics (shown in the syllabus in parenthesis). The best way to use lecture notes is to study them as the instructor is lecturing because they are close to a word for word record of the lecture. Hopefully, the advantage is that this system allows you to focus your concentration on the material and understand it during the lecture, where you can ask questions of the instructor, and where you only have to jot down perhaps a few points you

feel are missing from the notes. The regular note-taking system, in contrast, often forces a student to mainly concentrate on making sure he or she gets all the notes during a lecture. This usually causes the student to attempt an initial understanding of the material at home, where no one may be able to answer the student's questions. Using the lecture notes, the student will also have an excellent record of facts and definitions. The way not to use these notes is to think they are a substitute rather than a supplement and to never read the text. Experience has shown that most people who follow this latter procedure make a crash landing on the planet failure.

For discussion topics, blank space is left in the notes, your own note-taking is urged and you are encouraged to form your own opinion or conclusion regarding the topics, based on the analysis of the facts and your judgment. In cases where the text has no information on the subject, the instructor will provide materials upon request.

C. Lab Rules:
Lab reports are due the week following the lab. There are fairly stiff penalties for lateness: -5 the first week; -10 for each **day** after that since corrected labs will usually be handed back 1 week after they are due. Lab reports are expected to be neat and organized - a grader is in a much better mood (is more lenient?) when he or she has an easy time going through the work. When possible, try to work alone. Cross checking and discussion of labs outside of the classroom is not discouraged, but not when it gets to the point of plagiarism, which is grounds for automatic failure in the course. If you are stuck, please see the instructor during an office hour or by appointment.

10. TESTS:

A. There will be 3 (three) modular exams plus a final. The exams will be constructed as follows:
   I. 10 True-False. (20 pts).
   II. 10 Multiple Choice. (20 pts).
   III. 7 Fill-Ins. (14 pts).
   IV. 1 Diagram. (6 pts).
   V. 5 Definitions. (20 pts).
   VI. 2 Essays (20 pts).

B. Tests, except, of course the final which is comprehensive, will not cover material discussed before the previous test. For a given test, definitions will come from underlined words in the notes. Essay questions will come from the discussion topics, which deal with controversial issues in Astronomy.

C. Makeups, for valid reasons, are possible for the first two exams. (The last two come too close to the end of the semester, unless the student qualifies for, and agrees to take an INC. However, my makeups tend to be much more difficult than the original exam (to compensate somewhat for the extra time possible for study) and are thus discouraged. A dropped exam (see #10 below) is an alternative.

11. EVALUATION:

Your composite grade will be determined according to one of the following two formulas:

Plan A: Lowest grade does not occur on final exam.
- 20% Lab grade.
- 10% Instructor's evaluation
- 20% Highest regular test grade.
- 20% Second highest regular test grade.
- 0% Lowest regular grade (drop).
- 30% Final exam grade.

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Plan B: Lowest grade occurs on final exam.
- 20% Lab grade.
- 10% Instructor's evaluation
- 20% Each of 3 regular test grades.
- 10% Final exam grade.

However, please note: Unless the student meets the following minimum requirements, he (or she) will receive an F grade:

1. The student must pass (achieve 60 or above) on at least 1 of the 4 tests, regardless of the (possibly high) lab grades.
2. The student must complete and hand in at least 70% of the lab assignments regardless of the (possibly high) quality of the test grades.

12. FACULTY ABSENCE PROCEDURE. Please Note Well.

A daily listing of cancelled classes will appear in the glass case located next to the student center. Students can consult this case before going to class. If students find a class cancelled which has not been listed, they should report this to the evening and Saturday Office, Room C-107, or the Divisional Dean's Office, A325.

13. STUDENT ABSENCES.

The student is expected to obtain notes and assignments missed during office hours or by appointment. i. e., class time cannot be taken up to attend to affairs resulting from an individual student's absence.

14. SYLLABUS:

Class #	Lecture # (Discussion Topic#)		Topic
		I.	Introduction And Basics.
1	(1)		A. What Is Your Definition Of Life?
	(2)		B. Do You Believe There Is Life Elsewhere In The Universe?
2	1		C. Definition of Astronomy
			D. Temperature, Pressure, And Density
			E. Where We Are In The Universe
			F. Light And Spectra
			G. Radiation Laws
3	2		H. Tools Of The Astronomer
			I. Past And Future Space Missions of Note
			J. Brief History of Astronomy
			K. Kepler's Laws Of Planetary Motion
			L. Newton's Laws of Motion
			M. Newton's Law of Gravity
4	3	II.	The Earth As A Planet
			A. Shape
			B. Interior
	(3)		C. Plate Tectonics
			D. Atmosphere
			E. Magnetic Field; Van Allen Belts
			F. Rotational Revolutionary And Processional Motions
			G. Seasons
			H. Time
5	4	III.	The Moon
			A. Physical Characteristics
			B. Orbital Characteristics
			C. Phases
			D. Atmosphere
			E. Surface
			F. Appolo Missions And Results

Class #	Lecture # (Discussion Topic#)	Topic
(4)		G. Theories On The Origin Of The Moon H. Solar And Lunar Eclipses I. Tides
		TEST 1
6	5	IV. The Planets A. Comparative Planetology
	(5)	B. Principles of Planetology C. Mercury D. Venus
7	(6)	E. Comparative Evolutions Of Venus' And Earth's Atmosphere
	6	F. Mars
	(7)	G. The Viking Missions: Is There Life On Mars?
8	7	H. Jupiter I. Saturn
9	8	J. Uranus K. Neptune L. Pluto
		V. Other Solar Systems Objects A. Asteroids B. Comets C. Meteoroids D. Other Phenomena
		TEST 2
10	9	VI. The Sun A. Physical Characteristics B. Energy Sources For Stars C. Layers D. Sunspots And Other Features E. Terrestrial Effects Of The Sun
		VII. Stars A. Basics 1. Names 2. Stellar Distance Units 3. Stellar Luminosity And Brightness 4. Color 5. Spectral Classification 6. H-R Diagram 7. Mass-Luminosity Relation
11	10	B. Types Of Stars And Stellar Objects 1. Main Sequence 2. Red Giants 3. White Dwarfs 4. Planetary Nebulae 5. Cepheids And RR Lyra Stars 6. Hebig-Haro Objects And T Tauri Stars 7. Novae

Class #	Lecture # (Discussion Topic#)	Topic
		8. Supernovae 9. Cosmic Rays 10. Pulsars/Neutron Stars 11. Binary And Multiple Star Systems 12. Star Clusters
		C. Measuring Some Important Stellar Properties 1. Distances 2. Luminosities 3. Temperatures 4. Diameters 5. Masses 6. Compositions 7. Rotation
12	11	D. Interstellar Gas And Dust E. Nebulae
		VIII. Galaxies A. The Milky Way B. Other Galaxies 1. Types 2. Distances To Galaxies 3. The Local Group 4. Clusters of Galaxies 5. Receding Clusters of Galaxies 6. Unusual Galaxies 7. Active Galaxies 8. Quasars 9. Origin of Galaxies
		IX. Cosmology A. Hubble's Law B. Olber's Paradox
13	(8) (9) (10)	C. Steady State Universe D. Big Bang Theory E. Oscillating Theory
14	(11) (12) (13) (14)	X. Life Cycle Of Stars A. Birth Of Stars B. Prime Of Life Stellas C. Death Of Stars D. Stellar Black Holes
15	(15)	XI. Origin Of The Solar System
	(16) (17)	XII. Life A. Origin and Chronology Of Life OnEarth B. Chance Of Finding Life Elsewhere
		TEST 3
		FINAL EXAM

14. LAB SCHEDULE (LSW=LSW Associates Lab)

Week

1. Math Review, The Metric System, And Scientific Notation.
2. Light. (LSW #22).
3. Planetary Properties. (LSW #16).
4. Observation - Sperry Observatory, Union College.
5. The Moon. (LSW #s 9&10).
6. Drawing The Solar System To Scale. (LSW #2).
7. Planetary Configurations. (LSW #14).
8. The Planets. (LSW #s 17M, 17V, 18, 19).
9. Asteroids, Comets, Meteoroids. (LSW #s 3, 4, 5).
10. Our Star - The Sun. (LSW #26).
11. Stellar Magnitudes And Spectra. (LSW's 29, 30).
12. Methods of Distance Measurement.
13. H-R Diagram And Stellar Life Cycles. (LSW #31).
14. Cosmology. (LSW #35).