

Sample course outlines



Dear Instructor,

It often seems that there are as many ways of teaching a beginning astronomy class as there are instructors. Both the order of topics in a one-semester course and the specific subjects to include or emphasize always generate much debate whenever teachers of astronomy get together.

One of the key notions to emerge from recent studies of student learning in astronomy is that, in the 21st century, the range of astronomical knowledge is simply too broad to fit into an 11- to 16-week introductory course. By skimming over every topic from comets to cosmology, students are likely to feel that they learned very little.

As a result, more and more instructors are choosing to teach fewer topics in greater depth. For example, many universities and colleges are offering two introductory courses now: one in planetary science and one in stellar and galactic astronomy. At other institutions, instructors are creating new introductory courses by selecting certain themes or techniques and showing how they can be found in many different areas in astronomy.

This guide lists several approaches and groups of chapters that can be used for courses of different lengths and orientation.

Sincerely,

Andrew Fraknoi
David Morrison
Sidney Wolff



Sample course outlines



Inclusive Short Course, From the Earth Outward

This course could fit into one semester and still include the highlights of astronomy (including our planetary system). A number of chapters and sections are omitted entirely, and others, such as quasars, are shown in brackets as optional.

- Chapter 1: Science and the Universe
- [optional: Selected sections of Chapter 4: Earth, Moon, and Sky and perhaps parts of Chapter 3, Orbits and Gravity]
- Chapter 5. Radiation and Spectra (perhaps shortening the readings on spectra to match what you do in class)
- Chapter 6. Astronomical Instruments
- Chapter 7. Introduction to the Solar System
- Chapter 9. The Moon (omitting Mercury)
- Chapter 10. Venus and Mars
- Chapter 11. Giant Planets
- Chapter 12. Rings, Moons, and Pluto (at least Pluto, briefly)
- Chapter 14. Origin of Solar System [do Section 3 on the Formation of the Solar System only]
- Chapter 16. Nuclear Fusion and Stellar Interiors
- Chapter 17-19: Characteristics of the Stars [sections 17.2 and 18.3 could be done briefly or omitted]
- Chapter 21. The Birth of Stars and the Discovery of Planets
- Chapter 22-23. Stellar Evolution [with pulsars done briefly and gamma-ray bursts omitted]
- Chapter 24. Black Holes (sections 5 & 6 only)
- Chapter 25. The Milky Way
- Chapter 26. Galaxies
- [optional: Chapter 27. Quasars (in any case, you can omit section 3)]
- Chapter 28. Evolution and Distribution of Galaxies
- Chapter 29. Cosmology (omit sections 6 and 7 if short on time)
- Chapter 30. Life in the Universe (briefly)



Inclusive Short Course, Planets at the End

Many instructors prefer to teach a course which begins with stars and galaxies and then ends with a briefer consideration of the solar system and life elsewhere. Astronomy's section on the planets can stand alone and be used at any time in the sequence of a course.

- Chapter 1: Science and the Universe
- [optional: Selected sections of Chapter 4: Earth, Moon, and Sky and perhaps parts of Chapter 3, Orbits and Gravity]
- Chapter 5. Radiation and Spectra (perhaps shortening the readings on spectra to match what you do in class)
- Chapter 6. Astronomical Instruments
- Chapter 16. Nuclear Fusion and Stellar Interiors
- Chapter 17-19: Characteristics of the Stars [sections 17.2 and 18.3 could be done briefly or omitted]
- Chapter 21. The Birth of Stars and Discovery of Planets
- Chapter 22-23. Stellar Evolution [with pulsars and gamma-ray bursts done briefly or not at all]
- Chapter 24. Black Holes (sections 5 & 6 only)
- Chapter 25. The Milky Way
- Chapter 26. Galaxies
- [optional: Chapter 27. Quasars (in any case, you can omit section 3)]
- Chapter 28. Evolution and Distribution of Galaxies
- Chapter 29. Cosmology (omit sections 6 & 7 if short on time)
- Chapter 7. Introduction to the Solar System
- Chapter 9. The Moon (omitting Mercury)
- Chapter 10. Venus and Mars
- Chapter 11. Giant Planets
- Chapter 12. Rings, Moons, and Pluto (at least Pluto, briefly)
- Chapter 14. Origin of Solar System [do Section 3 on the Formation of the Solar System only]
- Chapter 30. Life in the Universe (briefly)

Short Course Omitting Planets Entirely

In some colleges, the solar system is not included in the first course in astronomy, either because it is covered in a separate course or because the instructor prefers to focus on stellar and galactic astronomy. Here is a one-semester sequence for such a course:

- Chapter 1: Science and the Universe
- Chapter 2. Observing the Sky [do section 1 only]
- Chapter 3. Orbits and Gravity [selected sections]
- Chapter 5. Radiation and Spectra (perhaps shortening the readings on spectra to match what you do in class)
- Chapter 6. Astronomical Instruments
- [optional: Chapter 15. The Sun – this covers the solar atmosphere and solar activity]
- Chapter 16. Nuclear Fusion and Stellar Interiors
- Chapter 17-19: Characteristics of the Stars
- Chapter 20. Between the Stars (section 1 and 2 only)
- Chapter 21. The Birth of Stars and Search for Planets
- Chapter 22-23. Stellar Evolution (omit 14.5)
- Chapter 24. Black Holes (sections 5 & 6 could stand alone, but become a lot clearer if students also read about general relativity)
- Chapter 25. The Milky Way
- Chapter 26. Galaxies
- [optional: Chapter 27. Active Galaxies and Quasars]
- Chapter 28. Evolution and Distribution of Galaxies
- Chapter 29. Cosmology (omit sections 6 & 7 if short on time)
- Chapter 30. Life in the Universe [as many or few sections as fit]

A Short Course about Planets and Exoplanets

In some colleges and universities, planetary astronomy is a separate introductory course for non-science majors. This is a course outline that covers the solar system but then extends its view to exoplanets as well.

- Chapter 1: Science and the Universe
- Chapter 2. Observing the Sky (selected parts)
- Chapter 3. Orbits and Gravity
- Chapter 4. Earth, Moon, and Sky (selected parts)
- Chapter 5. Radiation and Spectra (perhaps shortening the readings on spectra to match what you do in class)
- Chapter 6. Astronomical Instruments
- Chapter 7. Introduction to the Solar System
- Chapter 8. Earth as a Planet (selected parts)
- Chapter 9. The Moon and Mercury (some people omit Mercury if time is short)
- Chapter 10. Venus and Mars
- Chapter 11. Giant Planets
- Chapter 12. Rings, Moons, and Pluto (selected sections)
- [optional: Chapter 13. Comets and Asteroids]
- Chapter 14. Meteors, Meteorites, Origin of Solar System (selected sections)
- [optional: Chapter 15. The Sun – this covers the solar atmosphere and solar activity]
- Chapter 30. Life in the Universe (briefly)



A Course with an Emphasis on the Sky and the History of Astronomy

If your course focuses more on traditional astronomy and the history of astronomy, spending significant time on how students can observe the day and night sky, here is a sequence that emphasizes the chapters that treat these topics in particular:

- Chapter 1: Science and the Universe
- Chapter 2. Observing the Sky (selected parts)
- Chapter 3. Orbits and Gravity
- Chapter 4. Earth, Moon, and Sky (selected parts)
- Chapter 5. Radiation and Spectra (perhaps shortening the readings on spectra to match what you do in class)
- Chapter 6. Astronomical Instruments
- Chapter 7. Introduction to the Solar System
- Chapter 8. Earth as a Planet (selected parts)
- Chapter 9. The Moon and Mercury (some people omit Mercury if time is short)
- Chapter 10. Venus and Mars
- Chapter 11. Giant Planets
- Chapter 12. Rings, Moons, and Pluto (selected sections)
- [optional: Chapter 13. Comets and Asteroids]
- Chapter 14. Meteors, Meteorites, Origin of Solar System (selected sections)
- [optional: Chapter 15. The Sun – this covers the solar atmosphere and solar activity]
- Chapter 30. Life in the Universe (briefly)



Many other combinations are possible. Some instructors are teaching their planetary astronomy course with an astrobiology approach, in which case you might want to assign Chapter 30 earlier.

Others focus their course on a theme, such as cosmic evolution, cosmic violence, or the effects of gravity in the universe, using only selected sections of a textbook. We have put a number of features into Astronomy to assist instructors who take this route:

- when new terms are defined, they are shown in bold-face type and reviewed in the chapter summary
- if the term is used in a later chapter, it is frequently linked to the earlier definition or redefined
- the PDF version of the book allows you to find any term in the book (in Acrobat Reader, the find feature is the magnifying glass symbol)
- boxes occasionally review pertinent facts from previous chapters that are needed to follow the current discussion.

And, of course, you can always produce your own version of the textbook, including only the chapters and sections you want your students to read and adding a syllabus, notes, handouts, better jokes, etc.

The above suggested outlines are only a few of the ways we know our colleagues will be using the book. We welcome your suggestions and ideas for other outlines and sequences and may share some of them with your fellow adopters in future editions of this brief guide.