Syllabus:

The schedule reflects approximate timing only. If we need more time on a particular topic and less on others then we will fall behind or get ahead as needed.

1. Atmospheric Structure on the Planets: The static structure (Wks 1-4)
   1.1 Hydrostatic equilibrium. Stability and convection. Lapse rates on the planets. Water vapor in planetary atmospheres (Earth, Venus; Mars as a case study). Methane on Titan.
   1.3 Radiative transfer. Solar/UV (Mars as case study). Infrared. Radiative-convective equilibrium.
   1.4 Photochemistry on Earth, Mars, Venus.
   1.5 The upper atmosphere: Mesosphere, thermosphere, homopause, exosphere.
   1.6 Escape processes: Jean’s escape, hydrodynamic escape, impact erosion, sputtering.

2. Atmospheric Evolution (Wks 4-8)
   2.1 The solar nebula. Planetary formation processes and chemical equilibrium/mixing in the nebula.
   2.2 Early steam atmospheres. Ocean-vaporizing impacts on Earth.
   2.3 Noble gases and isotopes as indicators of atmospheric evolution. More atmospheric escape.
   2.4 Evolution of Earth’s atmosphere and climate over geologic history.
   2.5 Evolution of Mars’ atmosphere and climate
   2.6 Evolution of Venus’s atmosphere and climate
   2.7 Evolution of Titan’s atmosphere
   2.8 Atmospheric spectroscopy of extrasolar planets

3. Planetary Atmospheric Circulations: The moving structure (Wks 8-10)
   3.2 Large-scale vertical motion. Richardson number.
   3.3 Vorticity, potential vorticity. Atmospheric waves. Thermal tides.
   3.4 Mars: observed circulation
   3.5 Venus: observed circulation; superrotation
   3.6 Titan: observed circulation
   3.7 Triton and Pluto atmospheres. Thin atmospheres, e.g., Io.
   3.8 Jupiter & extrasolar planet gas giants.
Recommended Textbooks:

Broadly speaking, we will follow the material in De Pater and Lissauer. However, our coverage follows a slightly different order and also the De Pater & Lissauer book is sometimes insufficient for our purposes. Consequently, I will refer to other books as listed below from time to time.


Good textbooks that concisely cover the basic principles of atmospheric physics and chemistry to a level used in this course are:

*These books have a more “planetary” perspective compared to the others, especially Visconti.

Grade Components: Homework (60%). Paper on a planetary atmosphere topic of your choice (40%).