Astronomy 1: Introductory Astronomy

Spring 2006

Syllabus

v. 9: May 1, 2006

Week 1: Scale of the universe (Ch. 1 and begin Ch. 2)

Class 1 – Tue., Jan. 17: General information about the class, the sky and types of objects we'll be studying, principles, scale of the universe.

Class 2 – Thu., Jan. 19: Scale model, $v=d/t$, angular measure, small angle approximation, hand measurements, terms: zenith, etc., diurnal motion, Polaris, introduction to top-view and observer's view sketches.

Week 2: The night sky (finish Ch. 2)

Class 3 – Tue., Jan. 24: More angles, Yearly motion, zodiac, tilt of the Earth's axis and seasons.

Class 4 – Thu., Jan. 26: Moon's motion, combining diurnal plus other motions, intro to retrograde motion.

Week 3: More night sky – esp. moon phases, and beginning of ancient astronomy: the Geocentric system (begin Ch. 3)

Class 5 – Tue., Jan. 31: Seasons, Moon phases (with diagrams).

Class 6 – Thu., Feb. 2: Planetary motion, beginning of ancient astronomy, Greek astronomy, Ptolemaic synthesis and epicycles.

Week 4: Scientific ideas and history of astronomy, the nature of science, data, information display (review Ch. 3, *Tufte* reading)

Class 7 – Tue., Feb. 7: Eratosthenes, scientific models and the Ptolemaic model, parallax (Greek context).

Class 8 – Thu., Feb. 9: Copernicus, Tycho, Kepler, Galileo.

Week 5: Begin energy, motion, orbits (start Chs. 4, 5)

Class 9 – Tue., Feb. 14: The nature of science (Tufte discussion; also end of Ch. 3)

Class 10 – Thu., Feb. 16: Energy, work, KE, PE, conservation laws

Week 6: Energy, Dynamics, Newton – esp. orbits and Newton's version of Kepler's third law (Finish Chs. 4 and 5)

Class 11 – Tue., Feb. 21: Tue., Feb. 21: Matter, atoms, atomic structure; Circular motion (centripetal acceleration), mechanics, Galileo, gravity, Newton's laws. Newton's basis for Kepler's third law.

Class 12 – Thu., Feb. 23: **midterm**

Week 7: Light (Ch. 6; Sec. 16.2)

Class 13 – Tue., Feb. 28: How *F=ma* + F_gravity gives the indep of acceleration on mass, weightlessness; Review: Kepler's 3rd law (touching on gravity, mechanics…worked example – Kepler's version vs. Newton's version; satellite in low Earth orbit)

Class 14 – Thu., Mar. 2: Angular momentum, conservation laws, escape velocity; The nature of light – waves and particles; inverse square law, non-optical light and the EM spectrum, thermal emission and spectroscopy

Spring Break!

Week 8: More light…and telescopes and detectors (finish Ch. 6; Ch. 7)

Class 15 – Tue., Mar. 14: Review light: more spectroscopy, blackbody radiation,…more non-optical light

Class 16 – Thu., Mar. 16: *canceled class!*

Week 9: Telescopes; Solar System and its formation (more Ch. 7, begin Ch. 8)

Class 17 – Tue., Mar. 21: Kirchoff's laws (relation to atomic physics), Doppler shift, diffraction; begin telescopes…

Class 18 – Thu., Mar. 23: Telescopes: collecting area and resolution; detectors: exposure time and sensitivity; spectroscopy and Doppler shift application.

Week 10: Solar System and its formation, other planetary systems and beginning of unit on stars: Structure of the Sun, basics of stellar properties, (finish Ch. 8, Ch. 9; begin Ch. 15)

Class 19 – Tue., Mar. 28: Characteristics of the solar system: patterns in planet/moon spacing, orbits, rotation; terrestrial vs. Jovian; comets and asteroids; example of angular size of Mars (planets as worlds not just lights in the sky) and telescope resolution; dominance of Sun in the solar system and example of center of mass. Nebular hypothesis as explanation for key characteristics of the Solar System.

Class 20 – Thu., Mar. 30: Finish up solar system formation: computer simulations (moon formation too), other planetary systems and binary stars.

Week 11: Sun, continued…Stars: Properties, Hertzprung-Russell diagram, (finish Ch. 15, Ch. 16)

Class 21 – Tue., Apr. 4: Sun – structure, HSEQ (pressure-gravity balance) and self-regulation, fusion (and lifetimes).

Class 22 – Thu., Apr. 6: Stars: parallax and inv. Sq. law review,…using Sirius as an example for many of these concepts.

Week 12: Stellar evolution (star birth and death, remnants of stars) (Ch. 17); Wrap up stars – end states (Ch. 18)

Class 23 – Tue., Apr. 11: Surface temperatures, $L=4\pi R^2\sigma T^4$, spectral types, HR diagram, stellar masses and binary stars (anticipate white dwarfs with mass of Sirius B).

Class 24 – Thu., Apr. 13: Stellar evolution, pre-main-sequence and post-main-sequence evolution; low-mass stars

Week 13: Begin Galaxies: The Milky Way (Ch. 19)

Class 25 – Tue., Apr. 18: high-mass stellar evolution, supernovae, white dwarfs and neutron stars.

Class 26 – Thu., Apr. 20: Finish up end-states; Milky Way, role of supernova

Week 14: Other galaxies and the expansion of the universe (Hubble's law) (Ch. 20)

Class 27 – Tue., Apr. 25: Star-Gas-Star cycle, ISM, spiral structure

Class 28 – Thu., Apr. 27: Rotation curves, Galaxy types, Hubble law