PEP 351 Introduction to Planetary Science

Week 1	Review of the Solar system. Planet Earth.
Week 2	Motion in the gravitational field. Elliptic and hyperbolic orbits. Gravitational slingshot and gravitational capture.
Week 3	Formation of the planets: accretion and condensation in protoplanetary disk; interaction with radiation.
Week 4	Stability of the orbits. Planetary migration. Orbital resonances. Late heavy bombardment.
Week 5	Satellites, their formation and interaction with the planet. Tidal heating. Planetary rings.
Week 6	Radioactive dating. Evolution of the Earth-Moon system.
Week 7	Planetary atmospheres 1 - composition, atmospheric circulation, atmospheric escape.
Week 8	Planetary atmospheres 2 - greenhouse gases, Milankovich cycles, atmosphere-ocean interaction, Earth's energy budget.
Week 9	Heat sources in planetary interior. Mantle convection. Plate tectonics and earthquakes. Seismology.
Week 10	Planetary dynamo theory. Magnetic field reversal. Magnetic field in the cosmic environment.
Week 11	Geology of the icy moons. Kuiper belt objects. Rouge planets.
Week 12	Global warming: ice cores and other climate proxies.
Week 13	Extrasolar planets.
Week 14	Water on the Earth. Liquid water and habitable zones.

Prerequisites:

Mechanics (PEP 111 or equivalent)
Calculus 2B (MA 124)

Textbook:

'Planetary Science: The Science of Planets Around Stars' by George Cole and Michael Woolfson, IOP Publishing, Bristol and Philadelphia, 2002.

'Planetary Sciences' by Imke de Pater and Jack Lissauer, Cambridge University Press, Cambridge, 2010.

Course description:

The course introduces basic concepts of planetary science through the development of simple physical models. The first part of the course studies the planetary formation and related problems - evolution of the planet-satellite systems, orbital stability and impact events. The second part studies planets as equilibrium systems - topic include planetary atmospheres, climate cycles, seismic activity, and magnetism. The course concludes with the topics of current interest such as global warming, extra-solar planets, and planetary habitability.

The students will test the models by using the latest observational data, and develop computer simulations of the models studied in class.

Course Outcomes:

1. Calculate the energy released in the asteroid impact and compare it to the energies of nuclear explosions.
2. Develop a code to calculate the change of length of the day due to the tidal interaction with the Moon.
3. Calculate the first order increase in global temperature due to the given increase in atmospheric carbon-dioxide concentration.
4. Interpret the parameters of distribution of the known extrasolar planets in terms of the instruments available for the task.
5. Discuss the climate proxies and respond to the criticism of their applicability.