School of Physics

PHYS1160

Introduction to Astronomy and the Search for Life Elsewhere
Module 1 — Introduction

Lecture 1 — Introduction to Astronomy
The components of the universe (stars, planets and galaxies), the scale of the universe, a brief historical guide to the study of astronomy.

Lecture 2 — Introduction to Astrobiology
Why life might be common, or might be rare. The science of astrobiology. Where and how can we search for life in the universe?

Lecture 3 — Key Concepts

Lecture 4 — Techniques of Astronomy
Telescopes and instruments for different wavelength regions. Observing methods. Effect of the atmosphere. Observations from space.

Module 2 — The Solar System

Lecture 5 — The Solar System
Introduction to the solar system. Terrestrial and giant planets, satellites, dwarf planets., small solar system bodies. The formation of the solar system.

Lecture 6 — The Earth – Evolution of a habitable planet

Lecture 7 — Exploring the Solar System
Getting to a planet. Types of space missions. The key planetary exploration mission and what we have learnt from them. Ground-based studies of the planets.

Lecture 8 — Habitability in the Solar System
Definition of a habitable planet. Follow the Water. Past water on Venus. Evidence for water on Mars in the past and now. Evidence for oceans beneath the ice of Jupiter’s moons and Enceladus.
Module 3 — Life on Earth and in the Solar System

Lecture 9 — What is Life?

Lecture 10 — The History of Life on Earth

Lecture 11 — The Origin of Life
Historical ideas on life’s origin. The fundamental problem. The RNA World. Possible pre-RNA worlds. Origin of the building blocks of life. The timing of life’s origin relative to the late heavy bombardment. Could life have come from another planet?

Lecture 12 — Life in the Solar System

Module 4 — Stars

Lecture 13 — Our Star, the Sun

Lecture 14 — Properties and Evolution of Stars

Lecture 15 — Stellar Birth and Death

Module 5 — Other Worlds

Lecture 16 — Extrasolar Planets
Detection of exoplanets. Doppler, transit, microlensing methods. Types of and properties of exoplanets (e.g. hot Jupiters, eccentric planets). Comparison with our solar system.

Lecture 17 — Habitability and life on exoplanets
Lecture 18 — The Search for Extraterrestrial Intelligence (SETI)

Module 6 — Galaxies and Cosmology

Lecture 19 — Our Milky Way Galaxy

Lecture 20 — Galaxies and their Evolution

Lecture 21 — Cosmology
The expanding universe and Hubble’s law. The Big Bang theory. The cosmic microwave background. Dark matter and the evidence for it. The accelerating universe and dark energy, The standard model of the universe.

Resources for students
• The course textbook is “The Cosmic Perspective”, Bennett, Donahue, Schneider and Voit, 7th Edition, Pearson/Addison Wesley.
• A recommended additional book is “Life in the Universe”, Bennett and Shostak, 3rd Edition, Pearson/Addison Wesley, which gives more details on the Astrobiology aspects of the course.
• Links to additional material on the web will be provided on the Moodle site.