

ASTRONOMY (ASTR)

The Department offers courses in astronomy, both undergraduate and graduate, to support its three degree programs in astronomy and astrophysics. Note that Astrophysics honours students are required to include at least one graduate level course in their program, and students should refer to the Graduate Academic Calendar (<https://smu-ca-public.courseleaf.com/graduate/>) for graduate course descriptions.

The Department also offers introductory astronomy courses for the non-specialist, including ASTR 1000, 1001, and 1010. Both ASTR 1000 and 1001 are suitable for science electives for all students, whereas ASTR 1010 is suitable for a science elective for non-science students only (but still may be taken as a general elective by science students).

ASTR 1000 The Sky and Planets

3 credit hours

This course provides an introduction to the Solar System for non-science students with little background in science and mathematics. Topics include: the celestial sphere and the night sky, locating astronomical objects, motions and phases of the moon, timekeeping and the calendar, history of astronomy, eclipses, telescopes and instruments, planets, asteroids, and comets. Homework consists of assignments and labs, some of which require the use of the Burke-Gaffney Observatory. Classes 3 hrs. and lab/telescope observing 1 hr. per week

ASTR 1001 Stars & Galaxies

3 credit hours

This course is an introduction to astronomy beyond the Solar System for non-science students with little background in science and mathematics. Topics include: the Sun as a star, stars and star clusters, stellar evolution, nebulae, the Milky Way, galaxies and galaxy clusters, quasars, active galaxies, cosmology. Homework consists of assignments and labs, some of which require the use of the Burke-Gaffney Observatory. Classes 3 hrs. and lab/telescope observing 1 hr. per week

ASTR 1010 Life in the Universe

3 credit hours

What are the astronomical, biological, and sociological perspectives on extraterrestrials? Students examine the different types of worlds in our universe; the diversity of life-forms already discovered in extreme environments here on Earth; and the search for biological and intelligent life on other worlds within and outside our own solar system.

Note: This course is currently offered exclusively as a web-based course. Please note that this course may not be used by B. Sc. Students to satisfy the requirement of a science elective under regulations 3.e., 6.e., 10.c., and 12.b. for B.Sc. degrees.

ASTR 1100 Introduction to Astrophysics

3 credit hours

Prerequisite: PHYS 1210 [formerly PHYS 1100], and Nova Scotia grade 12 math pre-calculus, or equivalent

This course provides a mathematics-based and physics-based introduction to general and solar system astronomy for science students and astrophysics majors. Topics include: the celestial sphere and the night sky, development of astronomy as a science, orbits planets, time measurement, eclipses, telescopes and astronomical instruments, and the solar system. Homework consists of assignments and labs, some of which require the use of the Burke-Gaffney Observatory.

ASTR 1800 – 1825 Special Topics in Astronomy

6 credit hours

Course content varies from year to year.

ASTR 1826 – 1849 Special Topics in Astronomy

3 credit hours

Course content varies from year to year.

ASTR 2100 Foundations of Astrophysics

3 credit hours

Prerequisite: ASTR 1100; PHYS 1211 [formerly PHYS 1101]; MATH 1211

The emphasis of this first course in astrophysics is on directly observable quantities such as the positions and motions of stars and the light they emit. Topics include a review of the celestial sphere, time in astronomy, astronomical catalogues, the two-body problem, dynamics of star clusters, stellar spectra including emission and absorption lines, and the operation of telescopes. Students are assigned observing projects and trained to use the Burke-Gaffney Observatory.

ASTR 2400 Properties of Stars

3 credit hours

Prerequisite: ASTR 2100

One of the major scientific achievements of the 20th Century was the quantitative understanding of stars. This course reviews these advances including the use of binary stars to determine stellar properties, spectral classification and the Boltzmann and Saha equations, radiative transfer and stellar atmospheres, the equations of stellar structure, and the interiors of hydrogen burning stars such as the Sun.

ASTR 2800 – 2825 Special Topics in Astronomy

6 credit hours

Course content varies from year to year.

ASTR 2826 – 2849 Special Topics in Astronomy

3 credit hours

Course content varies from year to year.

ASTR 3400 Interstellar Matter and Stellar Evolution

3 credit hours

Prerequisite: ASTR 2400

This course examines the nature of neutral and ionised interstellar clouds and the onset of star formation. Concepts introduced in ASTR 2400 are used to show how the initial mass of a “protostar” largely determines its place on the “main sequence” as a star, its internal structure and energy production, and the nature of its death, whether it be as a white dwarf, neutron star, or a black hole.

ASTR 3500 Galaxies and Cosmology

3 credit hours

Prerequisite: ASTR 2400

This course deals with an extremely broad area of astrophysics covering seven or eight orders of magnitude in length scale. Topics include the kinematic properties of nearby stars, galactic rotation, spiral structure, and the formation of the Milky Way. Extragalactic topics include the classification of galaxies, galactic evolution and interaction, galaxy clusters, large scale structure of the universe, and modern cosmology including observational tests of various cosmological models.

ASTR 3800 – 3825 Special Topics in Astronomy

6 credit hours

Course content varies from year to year.

ASTR 3826 – 3849 Special Topics in Astronomy

3 credit hours

Course content varies from year to year.

ASTR 3876-3899 Directed Study in Astrophysics

3 credit hours

Prerequisite: Permission of the chairperson

ASTR 4200 Observational Astronomy

3 credit hours

Prerequisite: ASTR 2400

The principles of modern ground-based and space-based observational astronomy is discussed. Emphasis is on data acquisition (from observations and archives) and analysis, and on the statistical treatment of data. As much as practical, the Burke-Gaffney Observatory is used for student projects.

ASTR 4600 High-Energy Astrophysics

3 credit hours

Prerequisite: ASTR 2400 and PHYS 3410

Students discuss the astrophysical processes that create high-energy photons (x-rays and gamma-rays) as well as the emission created from very energetic electrons (synchrotron and inverse Compton). Topics include gas and radiative processes, high-energy detectors and telescopes, astrophysical processes from the solar system to black holes, and gamma-ray bursts responsible for high-energy emission.

ASTR 4800 – 4825 Special Topics in Astronomy

6 credit hours

Course content varies from year to year.

ASTR 4826 – 4849 Special Topics in Astronomy

3 credit hours

Course content varies from year to year.