
Astronomy

(offered by the Department of Mathematical Sciences)
Telephone number 012 429 6202

1

Introduction

Astronomy is one of the oldest and, at the same time, one of the most modern natural sciences. It no longer deals exclusively with the visible part of the electromagnetic spectrum – the so-called optical wavelength range; it has been considerably extended at the blue, short wavelength end and even beyond the ultraviolet (UV) and X-ray region, into the very high energy regime of the gamma-rays. With the latest developments in ground-based and satellite techniques we are also able to look beyond the red, long wavelength end of the optical band into the infrared (IR) and radio (submm, mm, cm, dm) regions.

As a result of its long history, Astronomy can be divided into two branches of study: the modern (astrophysical) and the classical (mathematical). Both fields are offered at Unisa at undergraduate and graduate level, and a major in Astronomy requires a curriculum including modules from both branches.

Astrophysics deals mainly with the study of the physical conditions, such as temperature, pressure, density and chemical composition, in stars, stellar systems and galaxies, as well as in the rarefied interstellar and intergalactic medium. But it is also concerned with stellar evolution and the structure of those extreme objects like white dwarfs, neutron stars and black holes.

Mathematical Astronomy comprises the study of the positions of planetary and stellar objects relative to Sun and Earth, or to each other. The motions of stars, stellar systems and galaxies provide insight into the dynamics of those systems, which yield valuable information on the masses of the celestial objects.

1.1 Requirements for admission to postgraduate studies

To qualify for admission to studies for the Honours BSc degree in Astronomy a student must hold a Bachelor's degree and, inter alia, have passed the modules prescribed for Astronomy as a major subject or the equivalent thereof.

Further particulars will be found in the departmental brochure on postgraduate studies.

2

General Information

- NOTE THAT, with certain exceptions, those who did NOT obtain at least 50% (D symbol) in Mathematics HIGHER GRADE or 80% (A symbol) on STANDARD GRADE at Matriculation level must pass MAT110 BEFORE they register for one or more of AST134 or the Mathematics modules MAT112, 113 and 103. Note also that modules in Physics (PHY) are a prerequisite for admission to AST251, 252 and 255.
- Students who passed one or more of the modules AST101–111, 201–212 and/or 301–323 prior to 1991 must contact the Department of Student Admissions and Registrations (Tel. 0861 670 411) BEFORE they re-enrol for any AST modules.
- The use of a pocket calculator is permissible in the examination for the following modules: AST131, 134, 251, 252, 361, 362, 363.
- Credit for a degree is granted for:
 - (i) either AST134 or AST132 and/or 133
 - (ii) not both AST101–111, 201–212 and/or 301–323 passed prior to 1991 and any of the present modules, except in consultation with the Department of Student Admissions and Registrations (Tel. 0861 670 411).
 - (iii) not more than two of AST243, 251 and 252
 - (iv) either AST341 or 361
 - (v) either AST342 or 362
 - (vi) either AST354 or 363
 - (vii) either AST361 or APM313
 - (viii) either AST362 or APM312

3

Astronomy as a Major Subject

At present, the curriculum for majoring in Astronomy comprises 9 modules.

A student who wishes to major in astronomy must also take modules in mathematics and physics.

The following combination of two major subjects is strongly recommended: Astronomy/Mathematics, Astronomy/Applied Mathematics or Astronomy/Physics.

Compulsory modules for a major subject combination:

First level: AST131, 134, MAT111, 103, any TWO of MAT101, 102, 112, 113 and PHY105, 106, 103, 104

Second level: MAT215, 216, AST251, 252, 255

Third level: AST355, 363, APM312, 313

3.1 SUGGESTED CURRICULA WITH ASTRONOMY AS A MAJOR SUBJECT

3.1.1 If Astronomy is selected as the only major subject for the BSc degree, there are 19 compulsory modules

In this case the other 11 modules required to complete the BSc degree can be selected from those in one or more of the other BSc subjects, provided that at least four of them are on second level, and four on third level.

3.1.2 If Astronomy and Mathematics are selected as major subjects, there are 28 recommended modules, namely

AST131, 134, AST251, 252, 255, AST355, 363
MAT111, 103, TWO of MAT101, 102, 112, 113, MAT211 or 212, 213, 215, 216, MAT302, 305, 306
APM111, 112, 113, 312, 313 plus any other 3rd level MAT module
PHY101, 102 (or 105, 106), 103, 104

In this case MAT301 or MAT311 can be taken instead of MAT306. The remaining three modules required to complete the BSc degree can be selected from those in one or more of the other BSc subjects provided that at least two of them are on second or third level.

3.1.3 If Astronomy and Applied Mathematics are selected as major subjects, there are 32 recommended modules. TWO of these must be taken for non-degree purposes (NDP) (see SC5(1)(e) in Chapter 3 of Part 7 of the Calendar)

AST131, 134, AST251, 252, 255, AST355, 363
APM111, 112, 113, APM203, 204, 211, 212, APM301, 302, 304, 305, 312, 313
MAT111, 103, TWO of MAT101, 102, 112, 113, MAT211, 212, 213, MAT306
PHY103, 104 (or 105, 106)

In this case another combination of four APM modules on third level may be selected.

3.1.4 If Astronomy and either Physics or experimental and/or theoretical physics are selected as major subjects there are at least 27 recommended modules, namely

AST131, 134, AST251, 252, 255, AST355, 363
PHY103, 104, 105, 106, PHY201, 202, 204, 206, PHY302, 303 and at least two of PHY306, 307 and 308
MAT111, 103, MAT112, 113, MAT215, 216
APM312, 313

In this case the other 3 modules required to complete the BSc degree can be selected from those in one or more of the other BSc subjects. CHE101, 103 introductory modules in Computer Science are recommended.

4

Syllabus

NB

All modules in this subject are offered as YEAR MODULES.

FIRST-LEVEL MODULES

AST131F General introduction to astronomy

Purpose: to enable students to obtain a broad and general introduction to astronomy (suitable for all students interested in the subject).

AST134J Spherical astronomy and Kepler orbits

Prerequisite:

ONE of the following:

- Mathematics HIGHER GRADE passed with 50% (D symbol) or 80% (A symbol) on STANDARD GRADE at Matriculation level
- MAT110
- Mathematics at Matriculation level passed before differentiation
- An equivalent examination in Mathematics – see Sc1(1)(b)(iv) in Part 7 of the Calendar
- MAT011 passed with at least 75%

Advice: Students who have not yet passed the following modules are strongly advised to register for them simultaneously: AST131, MAT110 (where applicable), MAT111.

Purpose: to gain insight into spherical trigonometry; celestial coordinate systems; times; aberration; precession and nutation and Kepler's laws.

SECOND-LEVEL MODULES

AST251N The structure and evolution of stars

Prerequisite: PHY103, 104, 105, 106, MAT112, 113

Advice: Students who have not yet passed AST131, AST134 and AST252 are strongly advised to register for them simultaneously.

Purpose: to enable students to understand energy sources and timescales, equations of stellar structure, the sun, stars, evolution on the Hertzsprung-Russell diagram, degenerate stars, binary star evolution.

AST252P The structure and evolution of galaxies

Prerequisite: PHY103, 104, 105, 106, MAT112, 113

Advice: Students who have not yet passed AST131, AST134 and AST251 are strongly advised to register for them simultaneously.

Purpose: to enable students to gain a basic insight into observational techniques that may be used to study the structure and dynamics of the Milky Way, galaxy morphology and evolution, and the large-scale structure of the universe.

AST255S Astronomy Practical

Prerequisite: PHY103

Advice: Results from AST134 are needed to solve problems in the AST255 assignments. Students who have not registered for AST134 should register for it together with AST255. Students are also strongly advised to register for the second-level Astronomy modules AST251 and AST252.

Purpose: to gain practical experience with the planning and preparation of astronomical observations (star charts, catalogues); determination of latitude (star transits); determination of azimuth (on the basis of solar observations); astronomical time-keeping; astrophotography.

THIRD-LEVEL MODULES

AST355V Advanced Astronomy Practical

Prerequisite: AST255

Advice: Students are strongly advised to register for AST363 simultaneously.

Purpose: to gain experience in preparing a professional observing run; photometry of variable stars; spectroscopy of various classes of star; double-star observations, and CCD photometry.

AST363V Observational Techniques

Prerequisite: Students must have passed the Astronomy Practical AST255 or the second year Physics Practical PHY204 or an equivalent module.

Purpose: to enable students to gain an understanding of the basic techniques of astronomical observations in order that useful information can be extracted from observing sessions.

5

Practical Work

AST255 and 355 will familiarise the students with observational techniques and instrumentation. They will include the preparation and execution of astronomical observations. The other modules in astronomy do not include practical work.

Students registered for these modules must attend a compulsory practical course, lasting 10 days (2x Monday to Friday) to be conducted in the UNISA observatory in Pretoria only during June/July. The course not only comprises the execution of the prescribed observations but also practical demonstrations and lectures.

Admission to the practical course is restricted to students who have satisfactorily completed a specified number of assignments.

NB

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- *The only examinations for these modules are conducted during the practical course in June/July.*
 - *For students living outside the Republic of South Africa special arrangements can be made after consultation with the Chairperson of the Department.*
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5.1 WEIGHT OF PRACTICAL WORK

In the following modules the percentage of the total marks awarded for the practical work shall be as follows:

AST255, 355.....100%