Department of Physics & Astronomy

Astronomy 1 X,Y

Course Guide

2006-2007

FAST FACTS

ASTRONOMY 1X AND ASTRONOMY 1Y

Status	A1X (2KPU) and A1Y (2KRU) are level 1 courses in the Faculty of Physical Sciences, and are each worth 20 credits. A1X is taught in semester 1, and A1Y in semester 2.
Class Head	Dr M A Hendry, room 607, telephone 0141 330 5685, email m.hendry@physics.gla.ac.uk
Laboratory Head	Dr I S Seng, room 232c, telephone 0141 330 6406, email i.heng@physics.gla.ac.uk
Class hours	Lectures and Tutorials, Monday to Friday at 1pm in Room 312, Kelvin Building. See notice board, website and moodle site for up-to-date information.
Lab Hours	Certain Mondays & Thursdays, 2.30-5.30 at Acre Road Observatory.
Entry Requirements	Maths at SQA Higher or equivalent. Physics at SQA Higher or equivalent is advised.
Examinations	A 2-hour written degree examination takes place at the end of both A1X and A1Y. This written paper is worth 75% of the total assessment, with laboratory work (15%) and written assignments (10%) making up the rest. Resit examinations are available for A1X and A1Y.
Prize	The top students in A1X and A1Y will each be awarded a prize.
Teaching Staff	Prof J C Brown, Dr D A Diver, Dr L Fletcher, Dr M A Hendry, Dr M Pitkin, Dr PH Sneddon, Dr L Teodoro, Dr G Woan
Web Site	http://www.astro.gla.ac.uk/a1/
Moodle Site	Access via http://moodle.gla.ac.uk/physics/moodle/

Note: Although the information contained in this booklet is believed to be correct, the booklet is only intended as a guide. Confirmation of important points can be obtained in the University Calendar and other official documents. Any changes which may arise during the course of the year will be announced to the class and posted on the notice board, website and moodle site.

A BRIEF DESCRIPTION OF A1X AND A1Y

Astronomy 1 (A1) is an introductory class for students who want to study honours Astronomy as a combined degree, or for students who just wish to know more about planets, stars, and general astronomy. The treatment of the subject is quantitative, involving some mathematics and physics.

A1 is divided into two parts, A1X and A1Y, which stand as independent 12-week modules. A1X concentrates on the solar system, A1Y on the wider universe: stars, galaxies and cosmology. There is also a laboratory component to both modules.

Each module has a similar structure and is worth 20 credits. Students can take just 1X, just 1Y or both 1X and 1Y. Together they constitute a prerequisite for taking Astronomy 2, and for proceeding to a combined honours degree in Astronomy. They may however be taken separately, a choice that might appeal to a student who has an interest in a particular aspect of astronomy but who does not wish to take the subject at honours level. Astronomy 1X takes place in the first semester, and is followed by Astronomy 1Y in the second semester.

Astronomy 1X deals with the solar system and space physics, and would be of particular interest to geophysicists, engineers, aerospace engineers, biologists, chemists, mathematicians, computer scientists and of course physicists.

Astronomy 1Y deals with stellar astrophysics, cosmology, and with observational astrophysics. It would be of particular interest to physicists, chemists, mathematicians, biologists and computer scientists and those interested in instrumentation.

For more details about the courses see the detailed syllabus on pages 17-22.

READING LIST

The following textbook is considered an **essential** purchase for Astronomy 1X and 1Y:

Astronomy Today (5th edition) by Eric Chaisson & Steve McMillan

ISBN: 0131445960 (published by Pearson Education)

We have negotiated a special deal with Pearson Education to supplement our editions of Astronomy Today with four chapters from **An Introduction to Modern Astrophysics** by Bradley Carroll and Dale Ostlie. These extra chapters cover crucial material in the A1X and A1Y syllabus which is not adequately covered by Astronomy Today. This unique package is *only* available to Glasgow University, and **it is therefore *essential* that students purchase their copy of Astronomy Today + supplement package from the Glasgow University Bookshop**. A special GU Bookshop price of £49.99 for the package has been negotiated; this price is competitive with e.g. the Amazon price of Astronomy Today alone. Students should therefore **not** purchase Astronomy Today online or from other bookshops as they will not receive the supplementary chapters.

Individual course lecturers may recommend other, more specialised, textbooks for consultation, but Astronomy Today is the *only* essential purchase for A1X and A1Y.

LECTURES AND LECTURE NOTES

The class meets four or five days a week at **1pm** for lectures and tutorials. See timetable for details. Lectures will be held in **Room 312** of the **Kelvin Building**, home of the **Department of Physics and Astronomy**. ***Come prepared to take notes at every lecture***. (Essential are a supply of paper and at least one writing implement!) The best arrangement is to use loose-leaf pre-punched paper, building up course notes topic by topic. This will also allow lecture hand-outs to be incorporated properly within the correct course element. Check the timetable to see what the next lecture is, and bring along the appropriate accumulated notes. It is good practice to read over lecture notes as soon as possible after the lecture has been delivered: this will help identify problems of understanding as they arise.

TUTORIALS AND ASSIGNMENTS

Class tutorials are held at which tutorial questions that have been set the week before are discussed. These tutorials will usually be held on Fridays, in Room 312, Kelvin Building. In addition written assignments that have been set the week before are required to be handed in at the beginning of the tutorial session. These sessions are vital to the course, providing a crucial opportunity for students to work with their peers, and question the tutors on aspects of the course. **Remember to bring all course notes with you to the tutorials.** Full solutions to the tutorial questions are made available after the tutorials. The written assignments that are handed in are marked and returned the following week.

The marks awarded for assignment work form an element of continuous assessment, and count towards overall degree performance. **Students should pay particular attention to the minimum requirements for award of credit for Astronomy 1X and 1Y (see Page 7)**. A failure to meet these minimum requirements will normally result in the award of no credit (i.e. a result of CR = 'credit refused') for these modules.

Note also that it is the official policy of the Department of Physics and Astronomy to impose a penalty on continuous assessment work which is submitted late: **10% of the assessed mark for submitted material will be lost per working day overdue; the possible credit will therefore taper to zero in 10 working days.**

See the notice board, web pages and tutorial handbook for more details.

LABORATORIES

There are 3 laboratory sessions in A1X and 3 in A1Y. These are held either at Acre Road Observatory or in the Kelvin building, on certain Monday and Thursday afternoons. A separate handbook detailing the laboratory sessions will be issued to students before the start of the laboratory sessions. You are required to read in advance the appropriate lab script for each experiment.

In addition to the scheduled laboratory sessions, students are also encouraged to attend voluntary evening sessions using the various telescopes which are housed at the Observatory. These sessions are usually run in cooperation with the student astronomy society, **Astrosoc**, and local amateur astronomy groups. Watch the noticeboard and websites for news of forthcoming events.

The facilities available at the Acre Road site include: a number of Meade Schmidt-Cassegrain telescopes, with apertures ranging from 200mm to 400mm; a 75mm transit telescope; a digital planetarium; a 17" Dobsonian portable Newtonian reflector and several 125mm portable Celestron refelector telescopes. The other Observatory at Cochno houses a 510mm Cassegrain f/8 telescope used both for research and for honours level projects in photometry and CCD experiments. A number of radio telescopes are also operational at the Acre Road site.

Students interested in carrying out observing at home may borrow one of our Newtonian Reflector telescopes. Some students may also have the opportunity to join the weekend observing trip, in Semester 2, organised for the Astronomy 2 class.

ATTENDANCE

Students are required to attend all lectures, tutorials and laboratory sessions. Attendance will be taken at all tutorials and labs, and taken randomly during lectures. These attendance records will form part of the performance assessment.

If for medical reasons you are absent for a period of up to 5 days (excluding Saturdays and Sundays) you should complete a Self Certificate of Absence available from the Principal Adviser's Office in the Boyd Orr building, and hand it in at that office. Copies are available to download from the Registry site at

http://www.gla.ac.uk/services/registry/students/forms/index.html

Please also hand in a copy to the class head Dr Hendry. This is particularly important when laboratory or tutorial sessions have been missed.

In the case of prolonged (greater than 5 days) or frequent absence, a medical certificate must be submitted to the Registry office. This must also be done if a student is unable to sit an examination through illness, or if an examination performance has been adversely affected by ill health. In addition you should inform the class head that a medical certificate has been submitted. More information on what to do in the case of absences is given in “A Student Guide” issued by the Registry.

EXAMINATIONS AND ASSESSMENT

- A 2-hour written degree examination will be held at the end of each module. This exam will be single marked. Copies of all past papers are held in the main library.
- The total assessment will consist of 75% from the degree examination;15% from laboratory performance; and 10% allocated from performance in the written assignments.

- Marks awarded for the laboratory and assignment performances are based on all such work submitted for assessment expressed in terms of the maximum available mark. Students must therefore submit all written work in order to maximise their score.
- The grades and corresponding grade points are as follows (extracted from the Senate's Code of Assessment (**http://senate.gla.ac.uk/academic/assessment/**)

Grade	Grade points per credit
A	16
B	14
C	12
D	10
E	8
F	6
G	2
H	0

- Note that failure to be awarded G or better means that the credits associated with the course are not counted towards the minimum graduating curriculum, nor are they used in calculating the grade point average.
- **Entry into Astronomy 2 requires a minimum of grade D in both A1X and A1Y**

MINIMUM REQUIREMENTS FOR THE AWARD OF GRADE G:

1. Candidates must have attended at least 2 out of 3 laboratory sessions in a module, and have submitted the associated work for marking
2. Candidates must have attended at least half of the tutorial sessions in a module, and must have submitted at least half of that module's assignment exercises.
3. Candidates must sit the degree examination, and must score a minimum of 10% of the marks available in the written paper
4. Note that candidates who do not meet the minimum coursework requirements (except in the case of illness or other good cause) will normally be awarded the result CR (= 'Credit Refused') for that module.

A resit examination for the written paper will be available for candidates scoring E or below in the first diet, though not for candidates awarded the result CR. In this case candidates' continuous assessment mark will be carried forward, but the highest grade achievable in a resit is D, irrespective of actual performance.

PLAGIARISM

In the A1X and A1Y modules, part of the assessment comes from laboratory work and tutorial work as already outlined. The warning about plagiarism that follows this paragraph is not intended to stop you discussing laboratory results and your tutorial problems with others in your class. Such discussions can be very useful in increasing your understanding of the subject. In the case of the laboratory work you can expect to work in small groups, and we encourage you to collaborate and share information freely. However your notes of the practical session, which are handed in and which will be assessed, should be an independent record of the afternoon's events and results. In the case of tutorial work, assignments, which are handed in for assessment, should again be an independent record of your attempt at the problems.

The following statement is taken from University regulations:

PLAGIARISM STATEMENT *(amended by Senate 5 June 2003)*

Introduction

31.1 The University's degrees and other academic awards are given in recognition of a student's personal achievement. All work submitted by students for assessment is accepted on the understanding that it is the student's own effort.

31.2 Plagiarism is defined as the submission or presentation of work, in any form, which is not one's own, without acknowledgement of the sources. Special cases of plagiarism can also arise from one student copying another student's work or from inappropriate collaboration.

31.3 The incorporation of material without formal and proper acknowledgement (even with no deliberate intent to cheat) can constitute plagiarism. Work may be considered to be plagiarised if it consists of:

- a direct quotation;
- a close paraphrase;
- an unacknowledged summary of a source;
- direct copying or transcription.

With regard to essays, reports and dissertations, the rule is: if information or ideas are obtained from any source, that source must be acknowledged according to the appropriate convention in that discipline; and any direct quotation must be placed in quotation marks and the source cited immediately. Any failure to acknowledge adequately or to cite properly other sources in submitted work is plagiarism. Under examination conditions, material learnt by rote or close paraphrase will be expected to follow the usual rules of reference citation otherwise it will be considered as plagiarism. Departments should provide guidance on other appropriate use of references in examination conditions.

31.4 Plagiarism is considered to be an act of fraudulence and an offence against University discipline. Alleged plagiarism, at whatever stage of a student's studies, whether before or after graduation, will be investigated and dealt with appropriately by the University.

Referral

31.5 Where a student is suspected of plagiarism[1] the member of staff shall refer the case to the Head of Department[2] or equivalent (hereinafter referred to as Head of Department) along with all appropriate documentary evidence (the piece of work in question duly marked-up, a copy of the original source of the plagiarism, information on the contribution of the piece of work to the overall assessment, etc). Any further departmental consideration of that piece of work shall be held in abeyance until the procedures set out below have been completed. The student shall be informed in writing that his or her marks have been withheld pending an investigation of suspected plagiarism.

31.6 The Head of Department shall assess the extent of the suspected plagiarism and, if necessary, consult with the Senior Senate Assessor for Discipline. The Head of Department will deal with suspected cases that are first offences and not considered to be severe. The Head of Department will refer all suspected second offences and cases of severe plagiarism directly to the Clerk of Senate or to the Head of the Senate Office for investigation under the provisions of the Code of Discipline.

31.7 Whilst there is no definitive list, examples of cases which would be regarded as severe plagiarism include:

(i) any case involving a final year undergraduate or any postgraduate student (taught or research);

(ii) any case of serious and or blatant plagiarism when considered in relation to the student's year of undergraduate study;

(iii) a first offence where a reduction in marks would put at risk the student's degree or direct progression;

(iv) any case, regardless of extent, where it is inappropriate to deal with it within a department.

Procedure before the Head of Department

31.8 At all times the principles of natural justice shall be observed.

31.9 With respect to cases that are first offences and not considered to be severe, the Head of Department shall interview the student concerned. He or she can also interview any students who have allegedly allowed their work to be copied. As soon as practicable, the student will be informed in writing of the alleged offence and of the requirement to attend for interview. The student will also be provided with a copy the marked-up piece of work in advance of the interview.

[1] If a student suspects a fellow student of plagiarism then he or she should speak to a member of staff in the department concerned. The identity of the student making the report shall remain confidential.

[2] Where the Head of Department has a potential conflict of interest (eg teaches or examines on the course concerned) then he or she should pass the case to another senior member of academic staff in the Department. In the case of small departments, where it may not be possible to pass the case to another senior member of academic staff, the case should be passed to the Head of a cognate department.

31.10 The student shall have the right to be accompanied, assisted or represented at the interview by one of the following: a parent or guardian; a fellow student or other friend; an Officer of the Students' Representative Council; a member of University staff, or a legal representative. At the beginning of the interview, the Head of Department will ascertain who is to be the spokesperson for the student (the student or a representative). The foregoing not withstanding, the Head of Department shall have the right to question the student directly, where necessary.

31.11 The Head of Department shall have a member of support staff present to keep a record of the meeting.

31.12 At the interview, the student will be shown a copy of his or her work, duly marked-up and be given a clear explanation of what he or she has allegedly done. The student will be given the opportunity to justify the work and be invited to admit or deny responsibility.

31.13 If the Head of Department is satisfied beyond all reasonable doubt that an offence has occurred he or she may impose an academic penalty, which will take account of the extent of the plagiarism. The Head of Department may reduce the marks or results up to the point where the academic rating for the piece of work in question is reduced to zero. Consideration will also be given to resubmission opportunities; the maximum mark that can be awarded to any resubmission is the pass mark appropriate to the degree programme being followed. The student shall be given instruction about plagiarism and the necessity of properly acknowledging and referencing sources.

31.14 If the Head of Department is not satisfied that an offence has occurred but considers that the student has engaged in poor academic practice then the student should receive a warning, instruction about plagiarism and the necessity of properly acknowledging and referencing sources.

31.15 The student will be notified in writing of the outcome. A copy will be kept on record in the Senate Office.

31.16 If it is judged that there is no case for the student to answer, the student will be informed in writing and the piece of work in question will be marked in accordance with normal arrangements, without penalty. The Senate Office does not need to be notified of such instances.

31.17 The Head of Department shall inform the Board of Examiners of any reduction in marks. The Board of Examiners shall not have the authority to revisit or alter academic penalties imposed by this process.

Right of Appeal

31.18 The student shall have the right of appeal to the Senate Assessors for Discipline in respect of any penalty imposed by the Head of Department. A student who wishes to appeal must do so in writing to the Head of the Senate Office within 14 days of the date of the issue of the written decision of the Head of Department.

31.19 The Senate Assessors for Discipline will consider an appeal against the penalty imposed by a Head of Department only on the grounds that:

(i) new evidence has emerged which could not reasonably have been produced to the Head of Department;

(ii) there has been defective procedure at the Head of Department level;

(iii) the penalty imposed by the Head of Department was clearly unreasonable.

The letter of appeal must clearly specify the details of any new evidence, the manner in which the procedures were defective or in what respects he or she believes the Head of Department has erred or been mistaken in imposing a penalty. The letter should also specify the remedy that the student seeks.

Plagiarism in the work of a graduate

31.20 The University will investigate any suspected case of plagiarism in the work of a graduate, which has already been assessed for an award of the University, to determine if the nature and extent of the plagiarism had been material to the award of the degree, diploma or certificate, or class within the degree.

31.21 All such cases will be considered as severe plagiarism. The Head of Department will conduct an investigation and refer the case to the Clerk of Senate or the Head of the Senate Office in accordance with §31.6 above.

FUTURE PROGRESS

We hope you will wish to continue to study astronomy for the rest of your academic career. Astronomy is taken as a Combined Degree, with Physics or Mathematics. A grade point average of 10 or better from Astronomy 1X and Astronomy 1Y is a prerequisite for entry into Astronomy 2. This can be achieved for example by obtaining grade D or better in both Astronomy 1X and 1Y. The following combinations are possible: Astronomy and Physics, Astronomy and Mathematics, Applied Mathematics and Astronomy. Each combination is offered in the following degrees: Combined Designated Ordinary BSc, BSc Combined Honours, and MSci Combined Honours.

OTHER IMPORTANT INFORMATION

Notice Board and Websites

Information on all aspects of the class is available on the notice board outside lecture theatre Rm. 312, Kelvin Building. The web pages at **http://www.astro.gla.ac.uk/a1/** are also a very useful source of information, and updates on the timetable and tutorial questions are placed here. It is very important to check the notice board and website regularly for new notices.

Astronomy 1X and 1Y also have their own Virtual Learning Environments, accessible via the Dept of Physics and Astronomy moodle website, at

http://moodle.gla.ac.uk/physics.moodle/

Using the A1X and A1Y moodle sites, students can:

- coordinate the timetables of all their courses

- receive regular updates and information about Astronomy 1X and 1Y
- discuss aspects of Astronomy 1X and 1Y with their classmates and teaching staff
- carry out self-assessment quizzes and exercises using the **ASTRONOMY TODAY** software (see **www.coursecompass.com**).

More details on how to use moodle and the Astronomy Today online resources will be provided in the lectures.

Observing opportunities

Voluntary night observing sessions are organised periodically at the Acre Road Observatory: keep an eye on the notice board and websites for further information. The Observatory has four portable 110mm Newtonian reflectors and these instruments may be available for private use.

Student - Staff Committee

Astronomy 1 elects two representatives to the departmental Student - Staff Committee. Agenda and minutes of the committee meetings will be posted on the notice board.

Student facilities

Common room

The department common room for staff and students is Rm. 470. The common room has hot and cold drink machines and a snack machine.

Student PC Cluster

Undergraduates enrolled in A1X or A1Y are able to use the departmental clusters of PCs in rooms 322 and 333.

Student library

The student library is located in Rm. 332. Some of the course textbooks can be found in the student library. Access information is usually displayed on the door of the library. An extensive reference library of textbooks can also be found at the Acre Road observatory.

Astrosoc

The student astronomical society, Astrosoc, undertakes to arrange social events and invited talks on burning issues of relevance to modern astronomers. Why not liven up your academic life, and participate socially? Don't forget the other student organisation within the department, Physoc, which runs several social events jointly with Astrosoc. Membership of these two sociable societies should brighten up many aspects of your departmental career!

Disability

If you have a disability, please let the class head know in advance. Every possible measure will be taken to make sure that you can participate in all activities. There is level entry to the Kelvin Building, and lift access to the lecture theatre and laboratories. Acre Road Observatory is all at ground level, except for the main dome, which can only be accessed via a spiral staircase, and two basement experiments which are not used at Level 1.

Special Needs

Should you have special needs in respect of course work or examinations, please inform one of the University's Special Needs Advisers: details can be found on the web at

http://www.gla.ac.uk/services/specialneeds/

The Special Needs Reception telephone number is **(0141) 330 5497**; you can also email:

specialneeds@gla.ac.uk

Please also inform the Head of Department, in plenty of time so that your needs can be accommodated.

Religious beliefs

If you have strict religious beliefs that you feel may cause a problem with attendance at any lecture, tutorial, laboratory or examination then please notify the class head at the beginning of the session.

Problems

Please don't suffer in silence. If you have any difficulties with the course, whether in comprehension or related to personal circumstances, please don't be hesitant in broaching the subject with us. You can approach the class head, the laboratory head, the lecturers concerned or your adviser of studies. The University Student Counselling Service is also there to help: they are at 65 Oakfield Avenue, and can be contacted by telephoning the receptionist, Mrs Rankine, on 0141-330-4528. Their website is

http://www.gla.ac.uk/services/counselling/index.htm

Calculators

Students should note that calculators with the facility to display information graphically, or having the capacity to manipulate formulae symbolically, are banned from use during examinations. Candidates must not bring such equipment into the examination hall. Any calculators of this type found during an examination will be removed, and the examination script endorsed accordingly.

Student must comply with the following extract from the Calendar, General Information for Students:

No calculator, nor any other hand-held electronic device, may be used by a candidate in an examination except with explicit departmental approval. Such approval shall normally take the form of a published notice on departmental notice board(s) together with a statement incorporated into the instructions to candidates in the appropriate examination paper(s).

Calculators or other hand-held electronic aids with a facility for either textual storage or display, or for graphical display, are excluded from use in examinations.

Certificate of Basic IT Competence

Senate has accepted a recommendation that possession of the University's Certificate of Basic IT Competence is a requirement of graduation for students of the University from October 1998 onwards. For more information on how to obtain this certificate you can contact the University IT education unit. The address of the IT Education Unit is the Reading Room, Upper Gallery, and its e-mail address is **iteu@gla.ac.uk** Any further information which we receive concerning this matter will be posted on the notice board and course websites.

WORKING TOGETHER AS A COMMUNITY

The Faculty of Physical Sciences is committed to working to promote race and gender equality and to providing opportunity and support for students with disabilities. This means we all have a part to play.

The content of our courses is either culturally independent, in the sense that experimental results should be the same for everyone, (if we can get it to work!) or they are ones where cultural positioning is important (such as in parts of Human Geography) and we explicitly study the effect of this. So we must use our time at University to look outside our own cultural origins, and to welcome contact and friendship with those from other backgrounds. Indeed, the new friends one makes at University, perhaps ones we never expected to make, can be amongst the greatest assets of our lives.

Students with disabilities are welcomed equally with all others, to share our enthusiasm for the ideas and challenges of our courses. I expect everyone in the Faculty to lend a hand of support to one another where needed.

If you have any personal concerns on these matters, in the first instance contact your Adviser of Studies or your class head.

May I wish you all the best in your studies here.

David Saxon

Dean, Faculty of Physical Sciences

ACRE ROAD OBSERVATORY

Director Dr. G Woan tel: 0141 330 8555 (internal, extension 8555)

Safety in the Observatory

The attention of students is drawn to the following points.

1. Care must be taken when using any electrical or electronic equipment. This is particularly necessary when using high voltage apparatus such as photomultipliers.

2. Under no circumstances may the sun be viewed directly through any optical aid, however small - telescope, coelostat, etc. Even momentary direct exposure of the eye to focused solar radiation will lead to permanent damage to eyesight, even blindness. **Never look directly at the sun through a telescope or binoculars.**

3. The use of photographic chemicals in the darkroom requires caution. Some are poisonous, some corrosive and some may produce skin irritations. Before using any chemical, make sure you are familiar with the accompanying instructions.

4. Equipment in the workshop is not to be used by students. In fact students should regard the workshop as out of bounds unless they have the express permission of the laboratory supervisor or whoever is on duty at the time.

5. Telescope / Coelostat Domes

* Telescope Dome: go up and down the stairs carefully. Avoid hitting your head on beam.

* Coelostat Dome: when going onto the roof, make sure the ladder is secure. Headroom is restricted so be careful. Hard hats are available and should be worn.

* Make sure that the hooks holding the hatches are secure, and do not use the hatches as a handrail. The hatches must not be left open when the telescope/coelostat is being used or adjusted.

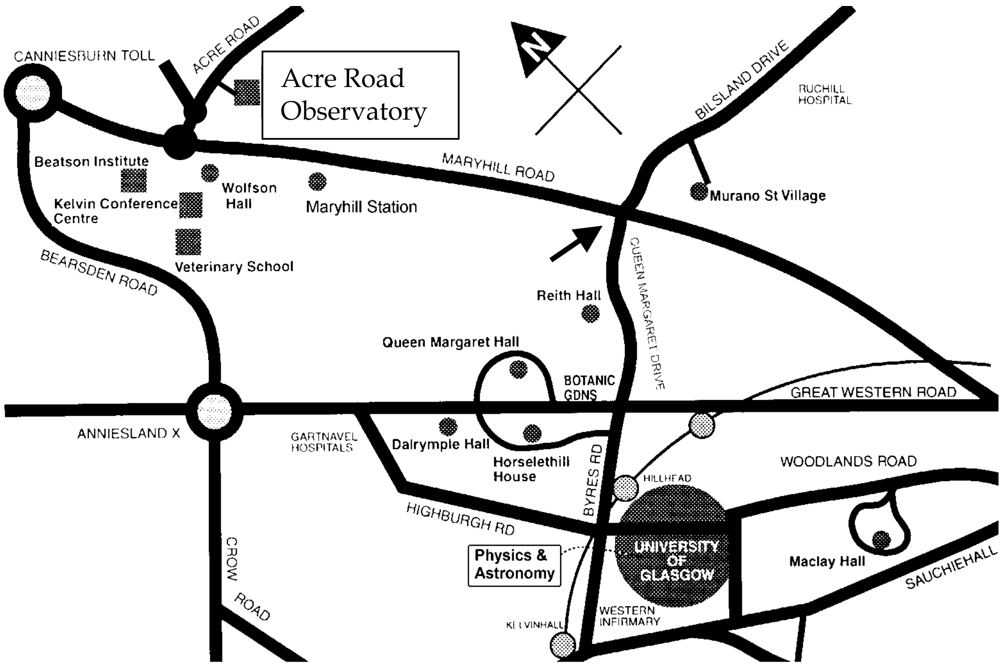
* Keep your hands clear of the rail when the dome-turning motor is in operation. In case of difficulty press the **red** button to stop the dome-turning motor.

6. As part of the University's Policy, the NO SMOKING RULE applies to the Observatory, The building is fitted with automatic smoke detectors and fire alarm buttons. Note that the **fire exits** are
(1) The main entrance doors
(2) in the library
(3) at the end of the corridor between laboratories E and F.

7. Every experiment has an accompanying instruction sheet which can be found in the laboratory handbook. Comments on safety relevant to that experiment are included in the sheet. Study the sheet carefully before beginning the experiment.

8. No student may undertake night observation alone. If the supervisor is not present, students must work in pairs (or in larger groups). **There can be no exceptions to this rule.**

HOW TO FIND THE OBSERVATORY



Transport to Acre Road

We will arrange for a fleet of taxis to convey you to the Observatory, provided you pay for all the journeys in advance. Early in each semester we will ask you to sign a commitment to pay the cost of 3 return journeys by TOA taxis, which will be around £12 in total for each semester's travel. This represents a considerable saving on the usual costs, simply because we can co-ordinate the efficient sharing of taxis; however it requires students to sign up early, so please do not delay, or you may be excluded.

If you are not travelling by taxi or private car, but by bus, we recommend that you first walk to the junction of Maryhill Road and Queen Margaret Drive (arrowed on the map) and take one of the many buses that travel up and down the Maryhill Road to Wolfson Hall and the Science Park.

On Maryhill Road Pick up No. 21, 23, or 23A (~7 minute services) all of which travel along Maryhill Road. No. 61 and 91 will take you only as far as Maryhill Railway Station.

Alternatively you can catch the No.57A on **Byres Road** (West side) which goes to Maryhill Station every 10 minutes. Also from Byres Road, you may wish to catch the No. 90 up to the junction of Maryhill Road and Queen Margaret Drive, and the No. 89 back.

Bus services are liable to change. There is a transport information desk in Hillhead Underground Station on Byres Rd which may be able to give you up-to-date information.

SYLLABUS FOR A1X

Each set of lectures forms one element of a structured introductory course in astronomy, and some overlap of material between courses in Astronomy 1X is inevitable. In particular when basic principles are expounded in one lecture course, it will be assumed that students are familiar with them in all subsequent courses, whether or not they are referred to explicitly.

Solar System Physics

number of lectures: 16 lecturers: Dr M A Hendry and Dr P L Sneddon

Course content

This course provides an description of the solar system, its structure, formation and evolution. The basic physics of radiation, gases, and gravitation is introduced and applied to simple models of the Sun, planets and other bodies in the solar system, and to models for the formation of the solar system.

The contents of the course are:

The planets - dimensions, masses, composition, and other properties; differences between terrestrial planets and the gaseous giants

Gravitation - surface gravity; escape speeds; tidal forces and lunar tides

Basic physics of radiation - black body radiation; Wien's Law and Stefan-Boltzmann equation

Application of radiation laws to the Sun and planets - effective temperature of the Sun; albedo simple derivation of the surface temperatures of the planets.

Basic physics of gases - gas laws; velocity distributions; light element escape from planetary atmospheres; hydrostatic equilibrium; isothermal atmospheres and scale heights.

Rocks - igneous, sedimentary, metamorphic and primitive rocks, differentiation, radioactive decay and dating.

Terrestrial planets and Moon - internal structure, notion of core, mantle and crust; chemical composition; volcanism and plate tectonics; cratering

Planetary atmospheres - chemical composition of atmospheres; the greenhouse effect; coriolis effect.

Jovian planets - internal structure; magnetospheres; rings and roche stability limit; description of main satellites

Meteorites, asteroids and comets - classification of meteorites into stony and iron; properties and clues to the origin of the solar system

The Sun - basic statistics; solar luminosity; nuclear fusion; energy transport in the solar interior, radiative and convective regions; properties of photosphere, chromosphere and corona

Solar activity - magnetic phenomena; solar wind; sunspots and butterfly diagram

Formation of solar system - evidence for nebula hypothesis; angular momentum; age of Earth, planets and Moon.

Learning Objectives: On completion of this course, the student should be able to:

1. describe the structure of the sun, the planets, the satellites and other minor bodies, and the structure and origin of the solar system
2. express the fundamental physical laws of blackbody radiation, gravitation, the gas laws and radioactivity
3. apply the above laws to describe and explain the properties of the bodies in the solar system and the evolution and formation of the solar system.

Positional Astronomy

number of lectures: 13 lecturer: Dr D A Diver

Course content

This course is concerned with the general appearance of the night sky, particularly the apparent movement of the stars and planets. Celestial co-ordinate systems are introduced in their appropriate forms, with the requisite grounding in spherical trigonometry a key part of the course. The comparison of these co-ordinate systems with the familiar terrestrial latitude and longitude is emphasised throughout.

The material covered in lectures is as follows:

The Sphere - explanation of the need for spherical geometry, definitions of great and small circles and the formulae relating them; spherical angles and spherical triangles; relation to spherical polar co-ordinates; radians and small angle approximations; terrestrial latitude and longitude, and definition of nautical mile; the cosine and other formulae

Geocentric Planetary Phenomena - direct and retrograde motion; inferior and superior planets; phase angle and elongation; relation of phase angle to phase; maximum elongation of inferior planet and minimum phase of superior planet; sidereal and synodic periods of planets; stationary points for superior planets; calculation of the elongation of stationary point of a superior planet

The Celestial Sphere - definition of terms: topocentric, geocentric, heliocentric; Alt-Azimuth co-ordinate system and position of north celestial pole; hour angle and declination; diurnal motion and circumpolar stars rising and setting; co-ordinate transformation via the triangle PZX (pole, zenith, star); right ascension and declination; local and Greenwich sidereal time; definition of the ecliptic and equinox; ecliptic latitude and longitude; relation of the equatorial and ecliptic co-ordinates via the triangle PKX (pole, ecliptic pole, star); annual variation of sun's co-ordinates; times of sunrise and sunset; examples of co-ordinate transformation and of the art of drawing celestial spheres.

Learning Objectives: On completion of this course, the student should be able to:

1. state the fundamental formulae of spherical trigonometry and be able to use and apply them to planetary motion and terrestrial navigation
2. describe the various co-ordinate systems (Alt-Azimuth, Equatorial and Ecliptic) and be able to transfer between them

3. solve problems concerning apparent motion of stars in the night sky

Dynamical Astronomy

number of lectures**:** 9 lecturer: Dr G Woan

Course content

This course introduces the student to Newtonian Gravitation, and its application to simple two body problems.

The material covered in lectures is as follows:

Planetary Orbits - properties of ellipses and concepts of eccentricity, perihelion and aphelion; Kepler's laws of orbital motion

Newtonian Gravity - Newton's law of gravitation; the gravitational constant G; surface gravity; convenient units for solar system calculations

Conserved Quantities - angular momentum, gravitational potential energy, total energy

Orbits - the escape velocity; parabolic and hyperbolic trajectories; centre of mass and mass correction; satellite orbits, and specification by orbital elements; transfer orbits; the earth-moon system; sidereal and synodic months; the eclipse year.

Learning Objectives: On completion of this course, the student should be able to:

1. state the basic concepts of Newtonian gravitation and associated phenomena
2. use these concepts quantitatively in various situations such as deriving surface gravity and escape velocities and determining properties of planetary orbits

SYLLABUS FOR A1Y

Each set of lectures forms one element of a structured introductory course in astronomy, and some overlap of material between courses in Astronomy 1Y is inevitable. In particular when basic principles are expounded in one lecture course, it will be assumed that students are familiar with them in all subsequent courses, whether or not they are referred to explicitly.

Observational Methods

number of lectures: 8 lecturer: Dr M Pitkin

Course content

This course is concerned with the basic concepts and principles regarding the design and performance of observational instrumentation. The electromagnetic spectrum is introduced, with a discussion of observing windows in different wavelength regimes. The design and properties of telescopes and detectors in the visual, X-ray, ultra-violet, infra-red and radio are assessed, and limiting operating characteristics evaluated.

The material covered in lectures is as follows:

Electromagnetic (EM) radiation - flux; polarization; frequency and wavelength; atmospheric windows; units associated with the various spectral regions used in astronomy; magnitude system.

Telescopes and their purpose - telescopes as flux collectors; light gathering power; signal strength and conversion to photon flux; telescope efficiency; limits of source detection; signal-to-noise ratio; angular resolving power.

Optical telescopes - basic geometric optics; refractors and reflectors (Newtonian, Cassegrain, Coude); effects of Earth's atmosphere; active and adaptive optics; visual use of telescopes; magnifying power; limiting magnitude.

Basic instruments - spectrometers; elements of the spectrometer; spectral resolving power; photomultipliers; CCDs; detector linearity.

Radio, UV and X-Ray astronomy - space telescopes for UV and X-ray observation; radio antennas and the 2-element interferometer; basic techniques for infrared astronomy,

Learning Objectives: On completion of the course, the student should be able to:

1. describe the electromagnetic spectrum, associated units, and properties of the atmosphere in different spectral regions.
2. explain the use of telescopes as flux collectors, including quantitative assessment of angular resolving power, magnifying power, telescope transmission and limiting magnitude.
3. describe the main types of modern astronomical detectors (photomultipliers and CCDs) and spectrometers, and explain the principles underlying their use.

4. apply their knowledge of the above directly to experimental measurements, and to solving quantitative problems involving the operation of multi-element telescope, instrument and detector systems.

Stellar Physics

number of lectures: 19 lecturers: Prof J C Brown (Stellar Evolution 1: 12 lectures)
Dr L Fletcher (Stellar Evolution 2: 8 lectures)

Course content

This course deals with the observations, classification, and modelling of stars and their evolution. The course divides into two parts - Stars and Compact Objects. The first part deals with the basic observations of stars in our galaxy, the different stellar types and their classification. We discuss the source of luminosity of stars, the structure of main sequence stars and their evolution off the main sequence. The second part deals with the later stages of stellar evolution and the properties of the so-called compact stars, white dwarfs and neutron stars, and black holes, and our theoretical understanding of these objects.

The material covered in lectures is as follows:

Measuring the stars -the sun; range of luminosities, masses and radii; effective temperatures

Star types - main sequence; red giant stars; white dwarf stars; variable and binary stars; light curves and radial velocity curves

Classification of stars - Hertzsprung-Russell (H-R) luminosity v temperature diagram; spectral classification (OBAFGKMRNS); chemical composition, mass luminosity relationship for main sequence stars

Stellar atmospheres -photosphere, chromosphere, and corona; absorption; scattering; line formation

Stellar models - hydrostatic equilibrium; estimates of central temperatures of main sequence stars; radiative equilibrium and convection; nuclear fusion; p-p chain and CNO cycle

Stellar evolution - typical evolution of 1, 5 and 10 $M_{\odot}$ stars; lifetimes of stars; H-R diagram and evolution

Supernovae

White dwarf stars - electron degeneracy pressure; relativistic effects and Chandrasekhar mass limit; mass -radius relation

Neutron stars - pulsars; gravitational accretion as source of luminosity; neutron star mass limit

Black holes - mass limit for neutron stars; event horizons; Hawking radiation

Learning Objectives: On completion of the course, the student should be able to:

1. describe the main types of stars, the spectral classifications of stars, and the Hertsprung-Russell (HR) diagram

2. discuss the physical principles needed to build simple models of main sequence stars
3. discuss the relationship between stellar evolution and the HR diagram
4. explain the nature of gravitational collapse and be familiar with the properties of compact stars and black holes
5. state the observational evidence relating to these stellar states

Introduction to Cosmology

number of lectures: 10 lecturer: Dr L Teodoro

Course content

This course presents a brief outline of modern observational and theoretical cosmology. The expanding universe is discussed in the light of the big bang model.

The course contents are:

Galaxies -the Milky Way; classification of galaxies; rotation curves and dark matter; redshifts; quasars; AGNs

Distance scales and structure of universe-distance determination; the Local Group; clusters and superclusters

The expanding universe - Hubble's law

Big bang model - cosmic abundances; critical density; age of the universe; radiation and matter dominated eras; decoupling of matter and radiation; helium production in the early universe; microwave background; structure formation.

Learning Objectives: On completion of the course, the student should be able to:

1. describe the properties of the main types of galaxies
2. discuss the large scale structure (clusters and superclusters) in the universe and their relative scales
3. explain the big bang model and its status in relation to cosmological observations

APPENDIX 1 SUMMARY OF A1X

Name of course: ASTRONOMY 1X
Teaching hours:
Level-1 Astronomy teaching comprises two successive 20 credit stand-alone modules of 190 learning hours (Astronomy 1X and 1Y) - each of 38 lectures, 10 tutorials and three 3 hour laboratory sessions - taught respectively in the first and second twelve week teaching periods.
Prerequisite:
Pass in Mathematics (SQA Higher or equivalent). Pass in Physics SQA Higher or equivalent is advised
Course Aims:
The Astronomy 1X&Y modules fulfil two functions - (i) as a whole they constitute a prerequisite introductory class for students who wish to study Astronomy as a combined honours degree (with Physics or Mathematics); (ii) as separate modules they enable students to obtain a basic knowledge of Astronomy, through two facets of it - the solar system (X) and stars, galaxies and cosmology (Y) - without necessarily continuing the subject to honours level. Together they present a comprehensive survey of modern astronomy and astrophysical phenomena, the topics in each being treated through a qualitative description and, where possible, simple quantitative modelling.
Each module is designed to:

- give students a good grasp of the fundamentals of Astronomy as a scientific discipline.
- train students in a broad range of scientific skills of practical and theoretical nature.
- develop the ability to apply these skills to solution of practical problems in Astronomy.

Detailed Aims for Astronomy 1X: 1. To present a general introduction to the subject of astronomy, and in particular the areas of solar system physics, positional astronomy and dynamical astronomy. 2. To introduce students to some practical aspects of astronomy through laboratory work. 3. To encourage students to work effectively and to grow in their ability to take responsibility for their own learning.

Learning Objectives for Astronomy 1X: On completion of the course, the student should be able to: 1. describe the structure of the sun, the planets, the satellites and other minor bodies, and the structure and origin of the solar system; 2. explain the fundamental physical laws of blackbody radiation, gravitation, the gas laws and radioactivity; 3. apply the above laws to describe and explain the properties of the bodies in the solar system and the evolution and formation of the solar system; 4. state the fundamental formulae of spherical trigonometry and be able to apply them to planetary motion and terrestrial navigation; 5. describe the various co-ordinate systems and how to transfer between them; 6. solve problems concerning apparent motion of stars in the night sky; 7. state the basic concepts of Newtonian gravitation and associated phenomena; 8. use these concepts quantitatively in various situations such as deriving surface gravity and escape velocities and determining properties of planetary orbits.

The student should also carry out three practical investigations in elementary astronomy, taking and analysing data, and reporting on their findings in written form

In addition to the above, the student should develop the following transferable skills:

- a thorough grounding in elementary scientific methods;
- an ability to assess and interpret data, both computationally and in an observational environment;
- numeracy and the capacity to understand simple mathematical models.

Syllabus:
The syllabus will involve the following topics:

Solar System Physics
Positional Astronomy
Dynamical astronomy.

Assessment:
One end of course degree examination of 2 hours in January, counting for 75%, with continuous assessment of laboratory work counting for 15%, and continuous assessment of tutorial work 10%.
If the result is E or worse, students may elect to take the re-sit degree exam in August/September. This will consist of a 2 hour paper counting for 75% with the remaining 25% coming from the carried forward continuous assessment mark. The re-sit grade will normally be D or worse, in accordance with the Faculty of Physical Sciences regulations.
Students who miss the end of course examination through illness or other valid reasons, will be allowed to sit the re-sit paper. There will be no restriction on the degree exam grade letter awarded.

Extract from Undergraduate Course Catalogue Entry:
2KPU Astronomy 1 X
Level 1
20 credits
Entry requirements:
Pass in Mathematics (SQA Higher or equivalent). Pass in Physics SQA Higher or equivalent is advised.
Degree examinations:
One end of course examination of 2 hours contributing 75%, plus continuously assessed tutorial and practical work contributing 25%.
Astronomy-1X: Lectures or tutorials at 13.00, 4 or 5 days weekly; practical on certain Mo. or Thu. 14.30-17.30.

Minimum requirement for the Award of grade G or higher.
There are 3 requirements which must be met for the award of a grade letter G or higher.

1. Students must attend at least 2 out of the 3 practical laboratory periods and submit the associated work for marking.
2. Students must attend at least 50% of the tutorials and submit half of the assignments for marking.
3. Students must sit the degree examination, and score a minimum of 10% of the marks available in the written paper

Students who do not meet the requirements (except due to certified illness or other acceptable cause) will not be awarded any credits for the course.

APPENDIX 2 SUMMARY OF A1Y

Name of course: ASTRONOMY 1Y

Teaching hours :

Level-1 Astronomy teaching comprises two successive 20 credit stand-alone modules of 190 learning hours (Astronomy 1X and 1Y) - each of 38 lectures, 10 tutorials and three 3 hour laboratory sessions - taught respectively in the first and second twelve week teaching periods.

Prerequisite:

Pass in Mathematics (SQA Higher or equivalent). Pass in Physics SQA Higher or equivalent is advised.

Course Aims:

The Astronomy 1X&Y modules fulfil two functions - (i) as a whole they constitute a prerequisite introductory class for students who wish to study Astronomy as a combined honours degree (with Physics or Mathematics); (ii) as separate modules they enable students to obtain a basic knowledge of Astronomy, through two facets of it - the solar system (X) and stars, galaxies and cosmology (Y) - without necessarily continuing the subject to honours level. Together they present a comprehensive survey of modern astronomy and astrophysical phenomena, the topics in each being treated through a qualitative description and, where possible, simple quantitative modelling.

Each module is designed to:

- give students a good grasp of the fundamentals of Astronomy as a scientific discipline;
- train students in a broad range of scientific skills of practical and theoretical nature ;
- develop the ability to apply these skills to solution of practical problems in Astronomy.

Detailed Aims for Astronomy 1Y: 1. To present a general introduction to the subject of astronomy in the context of the wider universe - namely the stars and galaxies, and cosmology. 2. To introduce students to aspects of observational techniques in astronomy. 3. To introduce students to some practical aspects of astronomy through laboratory work. 4. To encourage students to work effectively and to grow in their ability to take responsibility for their own learning.

Learning Objectives for Astronomy 1Y: On completion of the course, the student should be able to: 1. describe the electromagnetic spectrum, associated units, and properties of the atmosphere in different spectral regions; 2. explain the use of telescopes including quantitative assessment of various properties and consideration of ancillary instrumentation; 3. explain the principles underlying the use of astronomical detectors; 4. apply knowledge of the above to experimental measurements and to solving quantitative problems; 5. describe the main stars, the spectral classifications of stars, and the Hertsprung-Russell (HR) diagram; 6. state the physical principles needed to build simple models of main sequence stars; 7. discuss the relationship between stellar evolution and the HR diagram 8. explain the nature of gravitational collapse and be familiar with the properties of compact stars and black holes; 9. state the observational evidence relating to these stellar states; 10. describe the properties of the main types of galaxies; 11. discuss the large scale structure (clusters and superclusters) in the universe and their relative scales; 12. explain the big bang model and its status in relation to cosmological observations .

The student should also carry out three practical investigations in elementary astronomy, taking and analysing data, and reporting on their findings in written form.

In addition to the above, the student should develop the following transferable skills.

- a thorough grounding in elementary scientific methods.
- an ability to assess and interpret data, both computationally and in an observational environment.
- numeracy and the capacity to understand simple mathematical models.

Syllabus:

The syllabus will involve the following topics:

Observational methods
Stellar physics
Introduction to Cosmology

Assessment:

One end of course degree examination of 2 hours in May or June, counting for 75%, with continuous assessment of laboratory work counting for 15%, and continuous assessment of tutorial work 10%.

If the result is E or worse students may elect to take the re-sit degree exam in August/September. This will consist of a 2 hour paper counting for 75% with the remaining 25% coming from the carried forward continuous assessment mark. The re-sit grade will normally be D or worse, in accordance with the Faculty of Physical Sciences regulations.

Students who miss the end of course examination through illness or other valid reasons, will be allowed to sit the re-sit paper. There will be no restriction on the degree exam grade letter awarded.

Extract from Undergraduate Course Catalogue Entry:
2KRU Astronomy 1 Y
Level 1
20 credits
Entry requirements:
Pass in Mathematics (SQA Higher or equivalent). Pass in Physics SQA Higher or equivalent is advised.
Degree examinations:
One end of course examination of 2 hours contributing 75%, plus continuously assessed tutorial and practical work contributing 25%.
Astronomy-1Y: Lectures or tutorials at 13.00, 4 or 5 days weekly; practical on certain Mo. or Thu. 14.30-17.30.

Minimum requirement for the Award of grade G or higher:
There are 3 requirements which must be met for the award of a grade letter G or higher.

1. Students must attend at least 2 out of the 3 practical laboratory periods and submit the associated work for marking.
2. Students must attend at least 50% of the tutorials and submit half of the assignments for marking.
3. Students must sit the degree examination, and score a minimum of 10% of the marks available in the written paper

Students who do not meet the requirements (except due to certified illness or other acceptable cause) will not be awarded any credits for the course.

APPENDIX 3 CONDUCT OF WRITTEN EXAMINATIONS

INSTRUCTIONS TO CANDIDATES ON THE CONDUCT OF WRITTEN EXAMINATIONS

The following is an extract from the University Calendar 2003/2004, Section XXVIII

Instructions to Candidates

28.3 The following Instructions to Candidates on their Conduct in Written Examinations form part of the Rules for Invigilators

and invigilators must ensure that they are followed:

1. Candidates are required to obey the instructions of the invigilator. It is the duty of the invigilator to prevent any behaviour likely to cause disturbance to other candidates. Candidates needing to leave the room for any purpose must first ask permission of the invigilator, who may accompany the candidate.

2. Every candidate shall display for the invigilator's inspection a valid matriculation card.

3. Mobile telephones must not be used during examinations. Any mobile telephone in the possession of a candidate must be switched off for the duration of the examination. (Candidates are required to leave mobile telephones and bags at the front of the Examination Hall and not take them to their examination desks.)

4. No paper or book shall be brought into the examination room by any candidate unless with the express written permission of the appropriate Head of Department.

5. Unless with the express written permission of the appropriate Head of Department, candidates shall not give or receive any assistance, or communicate by any means with one another or with any person other than an invigilator at any time during the examination period.

6. No calculator, nor any other hand-held electronic device, may be used by a candidate in an examination except with explicit departmental approval. Such approval shall normally take the form of a published notice on departmental noticeboard(s) together with a statement incorporated into the instructions to candidates in the appropriate examination paper(s). Calculators or other hand-held electronic aids with a facility for either textual storage or display, or for graphical display, are excluded from use in examinations.

7. Candidates may not begin writing before the invigilator announces the start of the examination period and must cease writing when the invigilator announces the end of the period.

8. No part of any answer book shall be torn out or removed from the examination room.

9. In examinations of at least two hours duration, no candidate shall be allowed to enter the examination room after the first hour has expired, or to leave it within the first hour or the last half-hour. Except, that an invigilator may, at his or her discretion, allow a candidate to enter after the first hour if no other candidate has left the examination.

10. In shorter examinations, both entry and exit shall be at the absolute discretion of the invigilator.

11. In no case shall a candidate leave until an invigilator has collected his or her scripts or other examinable material.

12. These arrangements shall apply to all examinations, including those for the purpose of continuous assessment, held in the University.

Improper Behaviour of Candidates

28.8 If an Invigilator has reason to suspect a candidate of giving or receiving information in the examination room, the candidate's name and table number should be noted and the circumstances reported to the Clerk of Senate. If copying or other improper behaviour be clearly established, the Invigilator may require the candidate(s) concerned to leave the examination room and shall report the circumstances to the Clerk of Senate.

Any candidate who contravenes any of these instructions will be liable to penalties, which may include expulsion from the University.