ASTRONOMY COURSES 2006-2007

This booklet contains important information about your course; please read it carefully, then keep it with your notes so that you can refer to it as the course progresses.

Contents

The course web page can be accessed by registered students through MyEd portal.

https://www.myed.ed.ac.uk

Revision Sept 2006

The Course Organiser has tried to ensure that information given in this booklet is correct at the time of printing. Any alterations or amendments that prove necessary will be notified through the course web pages and posted on the Astronomy 1 notice board in the Appleton Tower concourse.

W. K. M. Rice

Course structure

Astronomy 1S: Stellar and Planetary Science is aimed at scientists, and is recommended, for example, to be taken by those students registered for Astrophysics. It concentrates on the physics and life story of stars and planets and how this illuminates our understanding of the Universe.

Discovering Astronomy G: Galaxies and cosmology is accessible to students taking a variety of courses. It is an introduction to the concepts and methods used by astronomers and discusses what, as a consequence, we know about our Universe.

In the next academic year the courses offered will be:

Astronomy 1G: Galaxies and cosmology is aimed at scientists, and is recommended, for example, to be taken by those students registered for Astrophysics. It concentrates on the physics and appearance of galaxies and our current understanding of the Universe that we inhabit.

Discovering Astronomy S: Stars and planets is accessible to students taking a variety of courses. It is an introduction to the Solar system and the Milky way Galaxy, and to other star systems.

Each of these courses is designed by itself to be exciting, up to date, and a rounded introduction to the ideas, methods and results of astronomy, taught by staff actively engaged at these frontiers. The Astronomy 1 courses, aimed at scientists (with mathematical background), are designed so that they can be taken in successive years to provide a more complete picture of the subject; the same is the case for the Discovering Astronomy courses which are aimed at non-scientists with a little mathematical background.

Enthusiasts may, with advice, opt to take both courses running in one academic year. Astronomy 1S and Discovering Astronomy S cannot be counted for credit together; neither can Astronomy 1G and Discovering Astronomy G.

Entry requirements

These half courses do not have a formal entry requirement. However, for entry to Astronomy 1, prior attendance at a physical science course to SCE Higher Grade or equivalent is desirable. Some simple calculus is used in parts of Astronomy 1, and the underlying physics is discussed throughout the course.

Complicated mathematics will not be used in Discovering Astronomy, but students are expected to be able to perform simple arithmetic and to understand basic geometry and simple algebra.

Astronomy Course Organiser: Dr Ken Rice ***Course secretary:*** Nathalie Dupin

	Course Organiser	Course secretary
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address: Institute for Astronomy
Royal Observatory
Blackford Hill
Edinburgh EH9 3HJ

The course home page is available on WebCT and can be accessed by registered students only through the MyEd portal https://www.myed.ed.ac.uk/. This website will include interactive course material, copies of the lecture notes, and self-test problems. Any notices or announcement will also be posted on this website, and there will be a discussion board allowing students to asks questions about the course or to provide feedback.

Registration

In addition to formal registration through your Director of Studies, you **must** also complete a course registration form; these are on the web **at the URL above**, and paper copies will be available at the first few lectures, and **should be returned promptly** so that tutorial groups can be arranged.

Timetable

Astronomy 1S and 1G run in the second semester, Discovering Astronomy G and S in the first. Lectures and tutorials are scheduled on Monday and Friday afternoons. Full details are given in this booklet, and may be updated on the course web pages (previous page).

Workload

In summary, **each** course has:

- 30 contact hours
- 5 tutorials (1 every two weeks) on Monday/Friday at 3pm, some including assessed work. This assessed work will count towards the final mark.
- 1 coursework exercise to be handed in (assessed and counts towards the final mark)
- self-assessment problem sheets (also strongly recommended)
- degree examination at the end of the course

Observing

Students should try to obtain some practical experience with telescopes, and once you are registered for Astronomy 1 or Discovering Astronomy you are entitled to **one free admission** to use the Popular Observing Telescopes at the Royal Observatory. This runs from 7.30 p.m. on Fridays normally between October and March. Check with the Royal Observatory Visitor Centre (0131-668 8404, 2-4pm) that there is observing that night. To obtain your free admission, present your matriculation card to the astronomer and sign opposite your name on the class register.

Textbooks

The Astronomy 1 course material does not follow a single textbook closely. A suitable first-year level textbook is:

M Zeilik, S A Gregory , "Introductory Astronomy and Astrophysics"
Saunders College Publishing (4th edition, 1998)

Some of the material, in particular the module of the The Structure of Stars, is taken from :

D Prialnik, "An introduction to the theory of stellar structure and evolution",
Cambridge University Press (2000)

Also suitable is:

M L Kutner, "Astronomy - A Physical Perspective"
Cambridge University Press (2003)

The recommended textbook for Discovering Astronomy, and for students taking Astronomy 1 with Discovering Astronomy, is:

"The Cosmic Perspective"
J Bennett, M Donahue, N Schneider, M Voit
Pearson/Addison Wesley (fourth edition, 2006)

Individual lecturers may recommend supplementary material from time to time; copies of this, and a few copies of the textbook, are usually available for consultation in the main library reading room.

Self-assessment

Problem sheets will be issued to give you practice in the type of problems often set in examinations. Answer sheets for these problems will be made available, so that you can check your work. If you have difficulties with the problems set, you should contact a member of staff in the tutorials.

Self-test problems will also be available on the course website on WebCT that can be accessed through the MyEd portal https://www.myed.ed.ac.uk/.

You are also expected to read through your lecture notes and handouts, and to read appropriate sections of the textbook. It is important that you wrestle with any difficulties for yourself before coming back to us if you are still stuck.

Assessed coursework

In each Astronomy course you will be asked to hand in an assignment by the specified date given in the detailed timetable information towards the end of this booklet. Details of the assignment (which may be essay, poster or numerical work) will be given several weeks in advance. You will have a choice of options for each assignment.

You **must** complete the coursework and hand it in **on time**. It will be marked and returned to you; there is a marking **penalty of 5% per working day,** for five days, with a mark of zero thereafter, for late work. **The assessed coursework is included in the final mark for the course;** see 'What is required to pass the course' below for details of how this is done. This means that any **marks lost for late coursework make it harder to pass the course**.

You must include a signed "Own Work Declaration" when handing in the coursework. A mark can be be given if this form is not signed and returned.

Examinations

The examination for all the first-year astronomy courses have the following format.

A two hour exam consisting of a multiple choice section, a short questions section and a problem-solving section.

Degree examination papers - but not multiple choice sections - for previous years are available (see our web pages). Departmental calculators will be issued for use in the examinations.

What is required to pass the course

The course grade and pass/fail will depend on the degree examination (or August re-sit) and the coursework marks. Note that, to be awarded a pass on the course, in addition to achieving the *overall* pass mark (40% on the University Common Marking scale) you must score a minimum of 35% on the Degree Examination itself. A student that scores achieves 40% overall, but scores less than 35% on the Degree Examiniation will fail with a U grade. The overall pass mark is calculated from:

- 2/3 examination
- 1/6 coursework assignment
- 1/6 assessed problems

Plagiarism

It is essential that work submitted for assessment is the student's own work. A necessary skill is the critical evaluation of published sources (which now include information on the Internet) and the work of others. All sources used ***must be acknowledged***. Plagiarism is treated very seriously as an offence by the University. Full details of the procedures can be found in the examination regulations.

Full details of the Examination Regulations are available online at:

`http://www.aaps.ed.ac.uk/regulations/exam.htm`

A paper copy of this document is also available from the Undergraduate Teaching Secretary in the Department of Physics and Astronomy.

Disability

If you have some disability which may affect your studies, you are asked to register, in confidence, with Ms Linda Grieve in the Teaching Office (School of Physics, James Clerk Maxwell Building, Room 4314, phone 650 5254).

Appeals

The University has two official channels for resolution of student grievances, these being the *Student Complaints Procedure* to deal with non-examination related issues and the *University Appeals Procedure* to deal with examination issues and results.

Student Complaints Procedure: Full details of the Student Complaints Procedure can be found online at:

`http://www.aaps.ed.ac.uk/regulations/Complaints/`

A paper copy of this document is also available from the Undergraduate Teaching Secretary in the Department of Physics and Astronomy.

Appeals Procedure: The formal University appeals procedure is detailed in the Degree Examination Regulations at

`http://www.aaps.ed.ac.uk/regulations/exam.htm`

Students considering a complaint or appeal are strongly advised to discuss the matter with their Director of Studies or with the Head of School.

Data protection

Personal information related to the course will be held and used within the constraints of the University's data protection registration.

Discovering Astronomy G: Galaxies and cosmology

22 September to 01 December

Monday 14.00 Appleton Tower, Theatre 1
Monday 16.10 Appleton Tower, Theatre 1
Monday 14.00 Appleton Tower, Theatre 1

Week			**Module**	**Lecturer**
First Term				
1	22 Sep	F2	Introduction	Dr WKM Rice
2	25 Sep	M2, M4	Setting the Scene	Prof AS Trew
	29 Sep	F2	Matter and Energy	
3	02 Oct	M2, M4	The Einstein Revolution	
	06 Oct	F2	Viewing the Universe	
	Coursework assignment set: Monday 9 October			
4	9 Oct	M2, M4	Stellar Properties	
	13 Oct	F2	Stellar Structure	
5	16 Oct	M2, M4	Star Birth	Dr WKM Rice
	20 Oct	F2	Stellar Clusters	
6	23 Oct	M2, M4	Massive Stars	
	27 Oct	F2	Star Death	
7	30 Oct	M2, M4	The Milky Way Galaxy	
	03 Nov	F2	The Local Group	
8	06 Nov	M2, M4*	A Universe of Galaxies	Dr MR Hawkins
	10 Nov	F2	Observing the Early Universe	*** short practice exam in M4**
	Coursework deadline: Friday 10 November			
9	13 Nov	M2, M4	The Lives of Galaxies	
	17 Nov	F2	Dark Matter and Dark Energy	
10	20 Nov	M2, M4	Structure Formation	
	24 Nov	F2	The Fate of the Universe	
11	27 Nov	M2,M4	The Big Bang	
	01 Dec	F2	The Big Bang and Inflation	
	04 – 15 December EXAMS			

Tutorials: at 3pm on Monday and Friday. The class will probably be organised into six groups. Each group will get 5 tutorials; details of dates, times and locations for each group will be posted on the Appleton Tower noticeboard, and in the course web pages.

Course requirements: We expect you to attend all the lectures and tutorials provided for you. The lectures present a guide to the material and set out the foundations of the course in the way that it will be examined (the lecturers are the examiners). The material covered by the exercises undertaken in the tutorials is intended to complement the lectures and may also be examined.

Astronomy 1S: Stars and planets **8 January to 23 March**

Monday	**14.00**	**Appleton Tower, Theatre 2**
Monday	**16.10**	**Appleton Tower, Theatre 2**
Friday	**14.00**	**Appleton Tower, Theatre 3**

Week			Module	Lecturer
First Term				
1	8 Jan	M2, M4	Surveying the Universe	Dr K Rice
	12 Jan	F2	Surveying the Universe	
2	15 Jan	M2, M4	Surveying the Universe	
	19 Jan	F2	Surveying the Universe	
3	22 Jan	M2, M4	Stellar Structure	Dr A Taylor
	26 Jan	F2	Stellar Structure	
	Coursework assignment set: Monday 29 January			
4	29 Jan	M2, M4	Stellar Structure	
	2 Feb	F2	Stellar Structure	
5	5 Feb	M2, M4	The Origin of Planets	Dr K Rice
	9 Feb	F2	The Origin of Planets	
6	12 Feb	M2, M4	The Origin of Planets	
	16 Feb	F2	The Origin of Planets	
7	19 Feb	M2, M4	Evolution of Stars	Dr M Cioni
	23 Feb	F2	Evolution of Stars	
8	26 Feb	M2, M4*	Evolution of Stars	
	Coursework deadline: Friday 02 March			
	02 Mar	F2	Evolution of Stars	
9	05 Mar	M2, M4	Star Death	Dr A Meiksin
	09 Mar	F2	Star Death	
10	12 Mar	M2, M4	Star Death	
	16 Mar	F2	Star Death	
11	19 Mar	M2, M4	**Short practice exam in M2, feedback in M4**	
	02 – 16 April EXAMS			

Tutorials: at 3pm on Monday and Friday. The class will probably be organised into six groups. Each group will get 5 tutorials; details of dates, times and locations for each group will be posted on the Appleton Tower noticeboard, and in the course web pages.

Course requirements: We expect you to attend all the lectures and tutorials provided for you. The lectures present a guide to the material and set out the foundations of the course in the way that it will be examined (the lecturers are the examiners). The material covered by the exercises undertaken in the tutorials is intended to complement the lectures and may also be examined.

1S. Surveying the Universe

Dr K Rice

This introductory module puts our Sun and other stars in perspective within the Universe. It reviews some of the basic physical ideas that are developed in the rest of this half-course, and introduces some of the concepts that are studied in detail in the other modules.

1. A whirlwind tour
   Earth to the edge of the Universe.
2. An eye on the sky
   What can we measure; how do we know?
3. Heat, light and atoms
   How spectra can tell us the contents, temperature and density of stars.
4. The HR diagram
   Stellar sociology. Luminosity and flux; temperature and colour.
5. Hot, hot, hot!
   The interiors of stars; the nuclear furnace; our 'birthplace'.
6. Birth and death
   How stars form and how they end.

1S. Stellar Structure

Dr A Taylor

Our knowledge of the internal structure of stars is one of the great achievements of modern physics. This may seem surprising in view of the fact that we can't actually see inside stars or perform experiments with them! This course looks at how the application of physics to the data from observational astronomy has given us great insight into how stars work.

1. Review of observational data
   The Sun; H-R diagrams; mass-luminosity relationship; summary of star properties.
2. Dynamical equilibrium
   Dynamical timescale.
3. Thermal equilibrium
   Thermal timescale.
4. Nuclear reactions
   Nuclear timescale.
5. Properties of models
   The main sequence.
6. Stellar Evolution
   Post-main sequence structure

1S. The Origin of the Planets

Dr K Rice

The Sun, Moon and planets include some of the most obvious astronomical bodies, and from earliest times have been included in mankind’s speculation on “origins”. This module begins with a look at past ideas about solar system formation, and an outline of the generally accepted model, before studying this model in more detail, and examining how it explains the observed properties of the solar system. We also look at the evidence for other planetary systems, and the evidence for violent activity in the solar system.

1. History of ideas, and what we have to explain
   Evolutionary and catastrophic theories; review of solar system contents and properties; the “solar nebula” model; other planetary systems?
2. Details of the Solar system
   Planetary orbits; solar and planetary rotation; orbital spacing; distribution of mass and angular momentum; cometary orbits; chemical compositions; the condensation sequence; overall abundances.
3. How to make planets
   Gravitational collapse, condensation, accretion; planetesimals; tidal disruption; planetary rings.
4. The Solar System in the Galaxy
   Location and epoch of Solar system formation in our Galaxy; timescale for formation; post-formation events leaving observable traces; the future of the solar system.
5. Extra-solar planets
   Importance for the solar nebula model; What are we looking for? Evidence for other planetary systems; future programmes
6. Impact events in a mature solar system
   Recorded events and near misses; the energy involved in a collision; dinosaur extinction? Can we prevent collisions?

1S. Evolution of Stars

Dr MR Cioni

During their life-time stars change structure and composition. These logical processes influence the environment on a very large scale. It is thought that nearly all of the chemical elements heavier than helium were made inside stars.

1. Nuclear Physics
   Abundances. Binding energy and nuclear reactions. Nuclear decays.
2. Nuclear burning in stars
   Hydrogen and helium burning. Making heavy elements, s- and r- processes.
3. Evolution of the stellar core
   The relation between density and temperature.
4. Evolution of the stellar surface
   Hayashi zone and pre-main sequence phase. The main sequence and red giant phases.
5. Advanced stellar evolution
   Helium burning in the core. Thermal pulses and the asymptotic giant branch. The evolution of massive stars.

6. The stellar life cycle
The interstellar medium. Stars, brown dwarfs and planets. Stellar populations and galaxies.

1S. Star Death
Dr A Meiksin

The late stages of a star's life give rise to some of the most dramatic phenomena in galaxies, and involve some novel and exciting physics. In this course we investigate the final states that a star may have: white dwarfs, neutron stars and black holes. We find stars with a central density of a billion tonnes per cubic centimetre, and stars the mass of the Sun spinning a thousand times a second.

1. Quick review of stellar evolution
Energy crises in a star's life; the final state.

2. Gentle and violent death
Planetary nebulae, supernovae and supernova remnants. How to estimate the energy of a supernova explosion.

3. White dwarfs
The strange physics of degenerate matter; the relation between mass and radius for a white dwarf; the maximum mass of a white dwarf. Explosive reactions.

4. Neutron stars and pulsars
Models of supernova explosions; structure of neutron stars.

5. Compact stars in binary systems
Novae and X-ray busters.

6. Black holes and introduction to general relativity
Gravitational redshift, gravitational bending of light.

Astronomy B: Frontiers of Astronomy **09 January to 24 March**

Monday 14.00 Appleton Tower, Theatre 5
Monday 16.10 Appleton Tower, Theatre 3
Friday 14.00 Appleton Tower, Theatre 5

Week				
2	09 Jan	M2, M4	Science of Astronomy	Dr M Hawkins
	First coursework assignment set: Monday 09 January			
	13 Jan	F2	Science of Astronomy	
3	16 Jan	M2, M4	Science of Astronomy	
	20 Jan	F2	Science of Astronomy	
4	23 Jan	M2, M4	Origin of the Planets	Dr M Kishimoto
	27 Jan	F2	Origin of the Planets	
5	30 Jan	M2, M4	Origin of the Planets	
	03 Feb	F2	Origin of the Planets	
6	06 Feb	M2, M4	Measuring the Universe	Dr A Meiksin
	10 Feb	F2	Measuring the Universe	
	First coursework deadline: Friday 10 February			
7	13 Feb	M2, M4	Measuring the Universe	
	17 Feb	F2	Measuring the Universe	
	Second coursework assignment set: Friday 17 February			
8	20 Feb	M2, M4	The Big Bang	Dr M Hawkins
	24 Feb	F2	The Big Bang	
9	27 Feb	M2, M4	The Big Bang	
	03 Mar	F2	The Big Bang	
	06 Mar	M2, M4	Black Holes	Dr M Hawkins
	10 Mar	F2	Black Holes	
	13 Mar	M2, M4	Black Holes	
	17 Mar	F2	Black Holes	
	Second coursework deadline: Friday 17 March			
	20 Mar	M2	**Practice exam**	
	24 Mar	F2		

Tutorials: at 3pm on Monday and Friday. The class will probably be organised into nine groups. Each group will get 4 tutorials; details of dates, times and locations for each group will be posted on the Appleton Tower noticeboard, and in the course web pages.

Course requirements: We expect you to attend all the lectures and tutorials provided for you. The lectures present a guide to the material and set out the foundations of the course in the way that it will be examined (the lecturers are the examiners). The material covered by the exercises undertaken in the tutorials is intended to complement the lectures and may also be examined.

B. The Science of Astronomy

Dr M Hawkins

This module introduces the scientific quest for an objective picture of the Universe, its history and fate. First we discuss what it means to be scientific. Then we discuss two classic "tools of the trade" and show examples of how we can learn about the Universe using them.

1. Whirlwind tour
   From the Earth to the edge of the Universe.
2. The Scientific Method
   What does it mean to be scientific?
3. Gravity and motion, part I
   How Newton's Laws explain the motion of the planets, and can be used to weigh stars.
4. Gravity and motion, part II
   How we know that galaxies are spinning, but faster than they ought to be.
5. Thermal radiation, part I
   What is it, and what does it tell us?
6. Thermal radiation, part II
   A spectral tour of the Universe. How the Universe looks different as our wavelength of vision shifts from radio through visible light to X-rays.

B. The Origin of the Planets

Dr M Kishimoto

The Sun, Moon and planets include some of the most obvious astronomical bodies, and from earliest times have been included in mankind's speculation on "origins". This module begins with a look at past ideas about solar system formation, and an outline of the generally accepted model, before studying this model in more detail, and examining how it explains the observed properties of the solar system. We also look at the evidence for other planetary systems, and the evidence for violent activity in the solar system.

1. History of ideas, and what we have to explain
   Evolutionary and catastrophic theories; review of solar system contents and properties; the "solar nebula" model; other planetary systems?
2. Details of the Solar system
   Planetary orbits; solar and planetary rotation; orbital spacing; distribution of mass and angular momentum; cometary orbits; chemical compositions; the condensation sequence; overall abundances.
3. How to make planets
   Gravitational collapse, condensation, accretion; planetesimals; tidal disruption; planetary rings.
4. The Solar System in the Galaxy
   Location and epoch of Solar system formation in our Galaxy; timescale for formation; post-formation events leaving observable traces; the future of the solar system.

5. Extra-solar planets
   Importance for the solar nebula model; What are we looking for? Evidence for other planetary systems; future programmes
6. Impact events in a mature solar system
   Recorded events and near misses; the energy involved in a collision; dinosaur extinction? Can we prevent collisions?

B. Measuring the Universe

Dr A Meiksin

The nature of the spiral nebulae revealed by large telescopes was until relatively recently the subject of controversy, culminating in the "Great Debate" between Shapley and Curtis in 1920. It became clear that the spiral nebulae were "island universes" comparable with our own Milky Way galaxy, that the structural scale of the observable Universe was much greater than had been supposed, and that the Universe was uniformly expanding.

1. The Solar System and beyond
   Early cosmologies; Greek distance estimates; distances of stars and star clusters.
2. "Standard candles" among the stars
   Identification of star types of "standard" luminosity, and their use to extend the distance scale.
3. The Milky Way
   Herschel and "the construction of the heavens"; debate on the extent of our Milky Way galaxy; rotation of the Galaxy.
4. "The Great Debate"
   The Shapley-Curtis debate of 1920. Discovery of Cepheid variables as distance indicators in spiral nebulae; vindication of the "island universe" hypothesis; recession of the nebulae.
5. The realm of the galaxies
   Distance indicators for external galaxies and clusters of galaxies.
6. Red-shifts and the Hubble constant
   Calibration of the extragalactic distance scale; Hubble's constant and the expansion of the Universe. Was there a Big Bang?

B. The Big Bang

Dr M Hawkins

Our current understanding of the entire Universe we live in and where it comes from is one of the greatest intellectual adventures of mankind. Since the revolution in physics started by Einstein it has become possible to give an amazingly simple and accurate description of the behaviour of the Universe from the first few seconds until the present moment. This module will describe the principles and outline the History of the Universe.

1. The appearance of the extragalactic sky
   Hubble's work on recession velocities and the present picture. The cosmological principle.

2. The consequences of the cosmological principle
Cosmological models - cosmic time and curved space (space-time). Recession and redshift.
3. The Universe at earlier times
The microwave background.
4. The Universe at earlier times
Recombination epoch, matter domination and radiation domination.
5. Physics at high energy and density
Particles and antiparticles. The origin of the light elements.
6. The History of the Universe.

B. Black Holes

Dr M Hawkins

Einstein's General Theory of Relativity makes a number of unusual predictions, the most curious of which is the possible existence of objects whose gravity is so strong that not even light may escape. In this module we look at some of the properties of black holes, consider how well General Relativity has been tested, and look at the evidence for black holes existing in the Universe.

1. Gravity
Escape velocity in Newtonian gravity. Light with 'weight' - the gravitational redshift. Time and curved space near black holes.
2. Testing General Relativity
Light bending; echoes from Venus; wobbles in Mercury's orbit; the binary pulsar; the Kerr galaxy; gravitational waves.
3. Stellar black holes
Maximum mass of neutron stars.
4. Active Galaxies
Seyfert galaxies; radio galaxies; quasars.
5. Energy from black holes
Accretion power; Eddington limit; accretion disks.
6. Black holes in normal galaxies
The Milky Way; Andromeda.

Astronomy C: Introduction to Astronomy **23 September to 02 December**

Monday 14.00 Appleton Tower, Theatre 3
Monday 16.10 Appleton Tower, Theatre 3
Friday 14.00 Appleton Tower, Theatre 3

Week		**2pm**	
1	23 Sep F	Introduction	Dr A Trew
2	26 Sep M2,4	Changing Cosmos	
	First coursework assignment set: Monday 26 September		
	30 Sep F2	Changing Cosmos	
3	03 Oct M2,4	Changing Cosmos	
	07 Oct F2	Changing Cosmos	
4	10 Oct M2,4	The Planets	Dr J Cooke
	14 Oct F2	The Planets	
5	17 Oct M2,4	The Planets	
	21 Oct F2	The Planets	
	24 – 25 October BREAK		
6	28 Oct F2	The Planets	
	First coursework deadline: Friday 28 October		
7	31 Oct M2,4	The Universe of Stars	Dr J Cooke
	Second coursework assignment set: Monday 31 October		
	04 Nov F2	The Universe of Stars	
8	07 Nov M2,4	The Universe of Stars	
	11 Nov F2	The Universe of Stars	
9	14 Nov M2,4	Cosmic Evolution	Dr M Hawkins
	18 Nov F2	Cosmic Evolution	
10	21 Nov M2,4	Cosmic Evolution	
	25 Nov F2	Cosmic Evolution	
11	28 Nov M2,4	Cosmic Evolution	
	02 Dec F2	**Practice exam**	
	Second coursework deadline: Friday 02 December		
	05 – 16 December EXAMS		

Tutorials: at 3pm on Monday and Friday. The class will probably be organised into five groups. Each group will get 4 tutorials; details of dates, times and locations for each group will be posted on the Appleton Tower noticeboard, and in the course web pages.

Course requirements: We expect you to attend all the lectures and tutorials provided for you. The lectures present a guide to the material and set out the foundations of the course in the way that it will be examined (the lecturers are the examiners). The material covered by the exercises undertaken in the tutorials is intended to complement the lectures and may also be examined.

Syllabus: the course follows the content of the recommended text closely.