MACQUARIE UNIVERSITY | FACULTY OF SCIENCE

Department of Physics and Astronomy
Semester 1, 2012

UNIT GUIDE

ASTR377 – Astrophysics I

3 Credit Points

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Practical (Lab) Supervisor:	Associate Professor Orsola De Marco	As above

UNIT WEB PAGE

The web page for this unit can be found at: http://www.physics.mq.edu.au/current/undergraduate/units/ASTR377

Please check this web page regularly for material available for downloading.

DESCRIPTION

ASTR377 is a core unit in the BSc Astronomy and Astrophysics program and is an option for students in the BSc program. This unit provides an introduction to astrophysics. It deals with the physics of emission, absorption and scattering mechanisms of astronomy; astrophysical fluid dynamics; and stellar structure and evolution. Students become familiar with the UNIX computing environment and the FORTRAN programming language as well as the use of modelling tools; finally, they carry out a computational project.

Changes to Previous Offerings

There are almost no changes compared the 2011 offering. The UNIX and FORTRAN exercises carried out during the first few weeks of the lab will not be assessed.

Here are notes from the SLC meeting pointing out shortcomings with the 2010 ASTR377 offering. These shortcomings have all been addressed (http://www.physics.mq.edu.au/ICSonly/meetings/)

CLASSES

Lecture 1	Wednesday, 8-9AM, W5C 210
Lecture 2	Wednesday, 9-10AM, E5A 230
Lecture 3	Friday, 1-2PM, C4A 325
Practical (Lab)	Wednesday, 2-5PM, E7B 213

NB Practicals (Labs) will commence in the second week of semester.

PRE-REQUISITES and CO-REQUISITES

PHYS201(P) and PHYS202(P) are pre-requisites.

MATH235 is a co-requisite.

EXPECTED LEARNING OUTCOMES

1. Knowledge of radiation mechanisms. Understanding the way radiation interacts with matter in different astrophysical environments.
2. Knowledge of the methods that allow us to interpret the physical characteristics of an astronomical object based on the light we receive from it.
3. Knowledge of the structure of our Sun and stars other than the Sun.
4. Knowledge of the processes and physics involved in stellar evolution (change over time).
5. Knowledge of computational environments and languages as well as techniques that allow us to model different astrophysical environments.

Graduate Capabilities Developed

1. Reading, interpreting and understanding reading resources
2. Numerical, quantitative and mathematical skills - assignment problems and practicals
3. Problem solving – assignments and practicals
4. Research and writing skills - practical project
5. Creativity - problem solving approach
6. Developing an appreciation of the nature of the physical world
7. Familiarity with important computer concepts and languages (UNIX, FORTRAN and PYTHON) - practicals

Generic Capabilities of a Physicist	How this unit addresses its development
Demonstrate knowledge of fundamental physics concepts, principles and theories	Unit teaches fundamental physics applied to a diverse range of astrophysical environments.
Evaluate the role of theoretical models and empirical studies in past and current development of physics knowledge	Unit teaches how we model a star and how we assess the quality of the model based on observed properties.
Apply physics principles to understand the causes of problems, devise strategies to solve them and test possible solutions	Unit's final project consists of an open ended problem to which creative solutions and ideas need to be applied and further tested.
Use a range of measurement and data analysis tools to collect data with appropriate precision and carry out subsequent analysis with due regard to the uncertainties	Unit's final project uses observational data as inputs. These data have several uncertainties, which need to be identified and propagated into the solution before conclusions can be reached.
Use the tools, methodologies, language, conventions of physics to test and communicate ideas and explanations	Unit's practicals and final projects are designed to use all the tools and techniques learned in the unit, including appropriate reporting techniques to communicate results and ideas to other scientists.
Work effectively and ethically in a multifaceted scientific environment	Unit's timeline promote an effective use of time and the development of organisational skills. The combination of lecturing, assignments, practical and project demonstrate the multi-faceted nature of physics as a discipline.
Be responsible, critically reflective, self-directed and motivated learners	Unit's lecture environment is such as to invite and promote critical discussion and to demonstrate the importance of formulating our own questions. Unit's assignments and practicals promote self-direction, discipline and motivation.

STUDY GUIDE

Required Text

Notes for the first half of this unit will be provided.

There are many useful textbooks on stellar astrophysics but the one below is strongly recommended:

An Introduction to Modern Stellar Astrophysics by Ostlie & Carroll

Several useful websites will be indicated during the lectures.

Teaching Strategy

This unit is taught through lectures, assignments, computational practical sessions and a final project. Unless there is an unavoidable clash, it is expected that students will attend all lectures: they provide a much more interactive and effective learning experience than studying a textbook. Much of the material is enriched via questions from the students and becomes inspiration for components of the lecture that can aid learning. Questions during and outside lectures are strongly encouraged in this unit – please do not be afraid to ask as it is likely that your classmates will also want to know the answer. You should aim to read the relevant sections of the textbook before and after lectures and discuss the content with classmates and lecturers.

This unit includes a compulsory computational component that is carried out over 12 weeks of 3-hour laboratory sessions. Students should attend all tutorials. Two assessable components will be produced during laboratory time. It is not expected that the students will work outside the laboratory time to produce these pieces of work.

You should aim to spend 3 hours per week working on the assignments. You may wish to discuss your assignment problems with other students and the lecturers, but you are required to hand in your own work (see the note on plagiarism below). Assignments are provided as one of the key learning activities for this unit, they are not there just for assessment. By applying knowledge learned from lectures and textbooks to solve problems, you will learn to test and develop your skills and understanding of the material.

Practical (Lab) Sessions

You should have a scientific calculator for use during the laboratory sessions. We expect to mark and return laboratory reports submitted on time within two weeks at most.

Practical (Lab) Attendance

Students will be expected to attend the laboratory on a weekly basis to report progress and receive tutorial assistance.

Schedule of Practical (Lab) Work

The first two weeks will involve working through the use of UNIX via tutorial exercises.

Weeks 2-3: The UNIX environment

Weeks 3-4: Introductory FORTRAN

Weeks 5-9: Computer-based exercises synchronised with the lecture topics – two assessable exercises.

Weeks 10-13: Project

Location of Practical (Lab)

E7B 213

ASSESSMENT

Summary of Assessment Tasks

Assignments (3)	(total) 20%
Practical Assessments	20%
Project	10%
Final Examination (3h 10min)	50%
TOTAL	100%

Requirements in order to complete the unit satisfactorily

Participation in the laboratory activity. Completion and satisfactory level of achievement in the practical project, assignments and formal examination.

Assignments (3)

The first is an "early assessment assignment" and is meant to identify possible learning and teaching challenges. The following two assignments will be based on the lecture material will be set at regular intervals. The assignments are an integral part of the unit and aid your understanding of the material. The total weight of the assignments on the final grade is 20% (the first, early diagnostic assignment is worth 6%; each of the following two, regular assignments is worth 7%).

Extension Requests: Given the importance we place on assignments as a key aid to learning we expect assignments to be submitted on time. In turn, we undertake to return your assignments (provided they were submitted on time), marked and with feedback within two weeks of their due date. This will allow us to provide you feedback in time to aid your ongoing learning through the course. Extensions will only be considered if requested with valid reasons prior to the due date. Penalty for late submission of assignments is the subtraction of 2% of the total achievable grade for every day of delay. The assignment cannot be turned in after 2 weeks past the official due date. For any problems with meeting the deadlines, please contact the Unit Convenor.

Practical Project

Students will undertake a practical project involving computer programming, astrophysical interpretation, report and presentation. Computational facilities will be available in the laboratory. The project will be undertaken during Weeks 10-13, and submission is due on Friday 3 June 2011, by 4PM. Penalty for late submission of the practical project is the subtraction of 2% of the final grade for every day of delay. The project cannot be turned in after 1 month past the official due date. For any problems with meeting the deadlines, please contact the Unit Convenor.

Final Examination

The final examination will be of three hours duration plus ten minutes reading time. Battery or solar powered calculators which do not have a full alphabet on the keyboard will be allowed into the examination. Calculators *with text retrieval* are not permitted for the final examination.

You are expected to present yourself for the final examination at the time and place designated in the University examination timetable (http://www.timetables.mq.edu.au/exam/). The timetable will be available in draft form approximately eight weeks before the commencement of examinations and in final form approximately four weeks before the commencement of examinations.

The only exception to not sitting the examination at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to apply for Special Consideration (see 'Special Consideration' in this Guide). If a supplementary examination is granted as a result of the special consideration process the examination will be scheduled after the conclusion of the official examination period. You are advised that it is the policy of the University not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, i.e. the final day of the examination period.

Teaching Feedback

Students can communicate their feedback on this course or on the lecturers directly to the lecturers, via official surveys which will be distributed towards the end of the semester and via the student liaison committee (see end of this document).

Relationship between Assessment and Learning Outcomes

The take-home assignments and the final exam test the problem solving ability of the student – the ability to apply different concepts and their physical and mathematical expression to the solution of new problems.

The laboratory assessment test the level of computational proficiency gained by the student as well as their understanding of how to create a model of a physical system as well as the caveats and pitfalls.

The final project tests how the student has learned to put together the computational and mathematical tools in the interpretation of a real physical system.

Standards Expectations

Academic Senate has deemed that the grades correspond to the following broad performance expectations (http://www.mq.edu.au/policy/docs/grading/policy.html):

Grade		**Mark %**	**Description**
HD	High Distinction	85-100%	Denotes performance that meets all unit objectives in such an exceptional way and with such marked excellence that it deserves the highest level of recognition.
D	Distinction	75-84%	Denotes performance that clearly deserves a very high level of recognition as an excellent achievement in the unit.
Cr	Credit	65-74%	Denotes performance that is substantially better than would normally be expected of competent students in the unit.
P	Pass	50-64%	Denotes performance that satisfies unit objectives.
F	Fail	0-49%	Denotes that a candidate has failed to complete a unit satisfactorily.

High Distinction
Problems are completed with correct solutions and appropriate working and clear relevant diagrams; student able to apply standard theory to solve novel problems.

Distinction
Problems are completed with occasional numerical error or incomplete working; some ability to apply taught material to novel problems or situations.

Credit
Most problems completed correctly.

Pass
Some problems completed correctly.

Fail
Inadequate demonstration of knowledge and ability to apply knowledge to solving problems.

Special Consideration

The University's policy for applying for special consideration may be found at:
http://www.student.mq.edu.au/ses/Special%20Consideration.html

Academic Honesty

The University defines plagiarism in its rules: "Using the work or ideas of another person and presenting this as your own without clear acknowledgement of the source of the work or ideas." Plagiarism is a serious breach of the University's rules and carries significant penalties. You must read the University's policies and procedures on plagiarism. The University's policy for academic honesty may be found at:
http://www.mq.edu.au/policy/docs/academic_honesty/policy.html

The policies and procedures explain what plagiarism is, how to avoid it, the procedures that will be taken in cases of suspected plagiarism, and the penalties if you are found guilty. Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Discipline Committee.

GENERAL REMINDERS

Student Liaison Committee

The Department of Physics and Astronomy values quality teaching and engages in periodic student evaluations of its units, external reviews of its programs and course units, and seeks feedback from students via focus groups and the Student Liaison Committee (SLC). Please consider being a member of the SLC, which meets once during the semester with the purpose of improving teaching via student feedback. Meetings are open and friendly, and invite honest feedback. Student representatives receive a list of outcomes from the preceding meeting. At the beginning of each meeting, an update on responses to feedback is provided by the Head of Department. Feedback is acted upon in a number of ways, mostly initiated via department meetings where decisions on actions are taken.

Student Support Services

http://www.mq.edu.au/currentstudents/

Student Portal

https://my.mq.edu.au/

Email Communication

Orsola.demarco@mq.edu.au

SCHEDULE OF TOPICS

Lectures will be presented on PowerPoint slides and on the whiteboard. Hard copies of the PowerPoint slides will be provided. Students are strongly encouraged to keep their own written (or typed) notes. The lectures will not be recorded.

Professor Mark Wardle (~ 18 lectures)

Radiation

Radiative transfer

Emission

Absorption and scattering processes

Fluid dynamics

Associate Professor Orsola De Marco (~ 18 lectures)

Stellar structure equations

Building stellar models

Stellar evolution and stellar classes

The physics of interacting binary stars