PHYS1160

INTRODUCTION TO ASTRONOMY

School of Physics

Faculty of Science

Term 1, 2022

Faculty of Science - Course Outline

1. Information about the course

NB: Some of this information is available on the UNSW Handbook[1]

Year of delivery	2022
Course Code	PHYS1160
Course name	Introduction to Astronomy
Academic unit	School of Physics
Level of course	1
Units of credit	6 UOC
Session(s) offered	Summer, Term 1, Term 2, Term 3
Assumed knowledge, prerequisites or co-requisites	None
Hours per week	Approximately 16 hours per week (during 10 week session) of self-directed study. Note that this course is fully online, so this time is spent watching videos, completing activities, contributing to discussion forums, answering problems, and completing assessments.
Number of weeks	10 weeks
Commencement date	14 February 2022
Grading	This course uses standard university grading.
Component	**Details**
Lessons	These are available online from links on Moodle. The course is divided into 5 modules, with each module containing 4 lessons (20 lessons in total). Each module should take about 2 weeks to complete.
Activities	There is 1 activity that accompanies every lesson (20 activities in total for the course). These activities give you problems to solve that are related to the content covered in the lessons and aim to deepen your understanding of the course material.
Discussion forum posts	Within each module, there is a discussion forum (5 discussion forums in total). Each module is allocated 2 weeks (except for module 3 which is due by the Monday of week 7), and you will be required to make contributions to the discussion forum within those 2 weeks. The aim of the discussion forums is to interact with your peers, and practice problem solving and communication skills.
Written assignment	Towards the end of the course, you will use the knowledge and communication skills you have gained in the course to write an article based upon a topic provided by the course facilitator.

[1] UNSW Online Handbook: http://www.handbook.unsw.edu.au

2. Staff Involved in the Course

Role	Name	Contact details	Consultation times	Queries
Facilitator The facilitator is your main point of contact during the term	Prof. Michael Ashley	m.ashley@unsw.edu.au	Email to arrange a time	Course content Administration questions
Editor	Kim-Vy Tran	kim-vy.tran@unsw.edu.au	Email to arrange a time	Administration questions
Teaching assistants (note you will be assigned to one of these via a group on Moodle)	Will be announced on Moodle			Queries related to marking
Other support staff	Zofia Krawczyk-Bernotas	z.krawczyk-bernotas@unsw.edu.au Room G06, OMB	Email to arrange a time	Administration questions

3. Course details

Course description (Handbook entry)	This course provides a broad overview of astronomy and our place in the cosmos. It covers the solar system and its exploration, stars, galaxies and cosmology, the Earth as a habitable planet and the search for life elsewhere in the universe. The course is delivered wholly on the internet through Moodle. The course is suitable as an introductory course for science students or as a general education course for non-scientists.
Course aims	This course aims to introduce students to introductory topics in astronomy. The course takes students through these concepts by starting at the Big Bang, and progresses through galaxy formation and evolution, the Milky Way, star formation and evolution, the Sun, the solar system, the Earth, astrobiology, exoplanets, and the end of the Universe.
Student learning outcomes	At the conclusion of this course students should be able to: • Have an understanding of key recent developments and concepts in areas including astronomy, space exploration, astrobiology and related disciplines, • Appreciate the interrelatedness of different scientific disciplines, • Understand the scientific method, what it means to study something scientifically, and the process of scientific discovery, • Know that science is a continuing international endeavour, and that scientists are diverse in age, gender, ethnic background and nationality, • Be competent in using resources on the internet to investigate scientific questions, and in preparing written reports on such investigations.
Graduate attributes developed in this course	
Graduate attributes	**These learning outcomes have been associated with this graduate attribute:**
The skills involved in scholarly enquiry	Understand the scientific method, what it means to study something scientifically, and the process of scientific discovery. Be competent in using resources on the internet to investigate scientific questions, and in preparing original written reports on such investigations.
The capacity for analytical and critical thinking and for creative problem-solving	Be competent in using resources on the internet to investigate scientific questions, and in preparing original written reports on such investigations.
The ability to engage in independent and reflective learning	Appreciate the interrelatedness of different scientific disciplines. Know that science is a continuing international endeavour, and that scientists are diverse in age, gender, ethnic background and nationality.
Information literacy: the skills to appropriately locate, evaluate and use relevant information	Be competent in using resources on the internet to investigate scientific questions, and in preparing original written reports on such investigations.
Relationship to other courses within the program	This is a stand-alone course as it is not a required course of any program.

Syllabus	**Module 1: Introduction**
	• Lesson 1: Introduction to Astronomy The components of the universe (stars, planets and galaxies), the scale of the universe, a brief historical guide to the study of astronomy. • Lesson 2: Introduction to Astrobiology Why life might be common or might be rare. The science of astrobiology. Where and how can we search for life in the universe? • Lesson 3: Key Concepts Forces and energy, gravity, Orbits and Kepler's laws. Atoms and nuclei. Light and other electromagnetic waves. • Lesson 4: Techniques of Astronomy Telescopes and instruments for different wavelength regions, observing methods, spectra and the Doppler shift. Effect of the atmosphere, observing from space.
	Module 2: The Solar System
	• Lesson 5: The Solar System Introduction to the solar system. Terrestrial and giant planets, satellites, dwarf planets., small solar system bodies. The formation of the solar system. • Lesson 6: The Earth – Evolution of a Habitable Planet Formation of the Earth and Moon. Age of the Earth. The heavy bombardment. Plate tectonics. Formation of oceans and continents. Evolution of the atmosphere. The faint-young Sun paradox and its resolution. • Lesson 7: Exploring the Solar System Getting to a planet. Types of space missions. The key planetary exploration mission and what we have learnt from them. Ground-based studies of the planets. • Lesson 8: Habitability in the Solar System Definition of a habitable planet. Follow the Water. Past water on Venus. Evidence for water on Mars in the past and now. Evidence for oceans beneath the ice of Jupiter's moons and Enceladus.
	Module 3: Life on Earth and in the Solar System
	• Lesson 9: What is Life? Properties of life. Classification of living organisms, Evolution and heredity. The molecular basis for life, DNA, RNA and proteins. • Lesson 10: The History of Life on Earth Methods for studying life's history. The fossil record. The earliest evidence for life. Molecular methods and the "tree of life". Extremophiles. Life and the Earth's atmosphere. • Lesson 11: The Origin of Life Historical ideas on life's origin. The fundamental problem. The RNA World. Possible pre-RNA worlds. Origin of the building blocks of life. The timing of life's origin relative to the late heavy bombardment. Could life have come from another planet? • Lesson 12: Life in the Solar System Ideas on life on Mars. Percival Lowell's canals. Early Mars missions. The Viking missions. The Martian meteorite ALH84001. Methane on Mars, Recent Mars missions. Life on the giant planet moons and how we could search for it.

	Module 4: Stars and Stellar Systems
	• Lesson 13: Our Star, the Sun The Sun's energy source. Nuclear fusion. Structure of the Sun. Solar activity. The Sun-Earth connection. • Lesson 14: Properties and Evolution of Stars Properties of stars. Spectroscopic classification. The Hertzsprung-Russell diagram. Types of stars. Evolution of low and high mass stars. Multiple stars. Star clusters. • Lesson 15: Extrasolar Planets Detection of exoplanets. Doppler, transit, microlensing methods. Types of and properties of exoplanets (e.g., hot Jupiters, eccentric planets). Comparison with our solar system. • Lesson 16: Habitability and Life on Exoplanets The problem of directly detecting exoplanets. Direct detection methods (giant ground-based telescope. nulling interferometers, coronagraphs, Occulters). Signatures of habitability. Biosignatures.
	Module 5: Galaxies and Cosmology
	• Lesson 17: Our Milky Way Galaxy Size and structure of the Milky Way. The disk, bulge and halo. Orbits of stars. The galactic centre. • Lesson 18: Recycling of Material in the Galaxy The interstellar medium. Molecular clouds. Star formation. Planetary nebulae. White Dwarfs. Supernovae. Neutron stars and black holes. • Lesson 19: Galaxies and their Evolution Types of galaxies. Distances of galaxies. Looking back in time. The Hubble deep field. Galaxy formation and evolution. Active galaxies and quasars. • Lesson 20: Cosmology The expanding universe and Hubble's law. The Big Bang theory. The cosmic microwave background. Dark matter and the evidence for it. The accelerating universe and dark energy, The standard model of the universe.

4. Rationale and strategies underpinning the course

Teaching strategies	This course is fully online. Each week the students will have videos to watch and course material to read as part of lessons that look at different concepts in astronomy. After completing each lesson, students will complete the associated activity, which consists of a set of questions related to each lesson. Feedback for incorrect answers will be provided. The activities (20 in total) contribute 30% to the final grade. While learning the material, during each module period students will be encouraged to ask and answer questions on discussion forums to develop their understanding of these topics and issues. A teaching assistant will mark the discussion forum contributions according to criteria provided on Moodle. Contributions to the 5 course discussion forums contribute 25% to the final grade. During the course, students will be allocated NASA Astronomy Picture of the Day (APOD) images. Students will select an image from the ones allocated to them to make the focus of an original written assessment. This allows students to choose an image related to topics that interests them and aims to improve students' research and communication skills. Students will submit the written piece to Turnitin via Moodle in two phases: a draft worth 5% and the final assessment worth 15%. Marking will be done by a teaching assistant. At the end of the course, students will complete a final exam. The final exam is conducted online at a specified time during the examination period and contributes 25% to the final grade.
Rationale for learning and teaching in this course	This course aims to expose students to a wide variety of astronomy concepts and engage them by allowing creativity and the freedom to research their own interests. The rationale behind this approach is to give students astronomical literacy (i.e., allow them to read and understand a variety of media about astronomy) and engage their sense of wonder for astronomy by allowing independent research on a topic of choice. By allowing student-directed assessments, students' intrinsic motivation to complete the assessment tasks increases. Additionally, students gain vital research and communication skills that can be applied to future employment situations.
Rationale for assessment in this course	As this course aims to increase the astronomical literacy and sense of wonder for astronomy of each student, the capstone assessment for the course is an original written assessment. Students are assigned at least two NASA APOD images, of which the student chooses one to be the focus of their assessment. Giving students flexibility in the topic of their assessment allows them to follow their interests and increases intrinsic motivation. Additionally, students engage their creativity by formatting the assessment in any style they choose, provided that the information can be conveyed sufficiently. The skills needed to complete the assessment are scaffolded during the course by participation in the discussion forums, where students will ask questions of their peers about a topic that they found interesting that fortnight and will research and answer their peers' questions. Students also submit a draft of the assessment and get feedback from tutors on their approach. To ensure astronomical literacy, students will complete astronomy questions based on the concepts covered in each lesson. This prepares students for their final exam, which is a timed quiz on Moodle set during the examination period.

5. Course schedule

Week	Module	Lesson	(Optional) Textbook chapter	Assignment and submission dates (see also 'Assessment tasks & feedback')
Week 1	1: Introduction	Lesson 1: Introduction to Astronomy Lesson 2: Introduction to Astrobiology	1, 3, 4, 5, 6	Activities 1* & 2*
Week 2		Lesson 3: Key Concepts Lesson 4: Techniques of Astronomy		Activities 3* & 4* Module 1 discussion contribution (Friday)
Week 3	2: The Solar System	Lesson 5: The Solar System Lesson 6: The Earth	7, 8, 9, 10, 11, 12	Activities 5* & 6*
Week 4		Lesson 7: Exploring the Solar System Lesson 8: Habitability in the Solar System		Activities 7* & 8* Module 2 discussion contribution (Friday)
Week 5	3: Life on Earth and in the Solar System	Lesson 9: What is Life? Lesson 10: The History of Life on Earth Lesson 11: The Origin of Life Lesson 12: Life in the Solar System		Activities 9* & 10* Activities 11* & 12* Written assignment draft (Friday)
Week 6		Flexibility Week – no new material		
Week 7	4: Stars and Stellar Systems	Lesson 13: Our Star, the Sun Lesson 14: Properties and Evolution of Stars	13, 14, 15, 16, 17, 18	Module 3 discussion contribution (Monday of Week 7) Activities 13* & 14*
Week 8		Lesson 15: Extrasolar Planets Lesson 16: Habitability and Life on Exoplanets		Activities 15* & 16* Module 4 discussion contribution (Friday)
Week 9	5: Galaxies and Cosmology	Lesson 17: Our Milky Way Galaxy Lesson 18: Recycling of Material in the Galaxy	19, 20, 21, 22, 23	Activities 17* & 18* Written assignment (Friday)
Week 10		Lesson 19: Galaxies and their Evolution Lesson 20: Cosmology		Activities 19* & 20* Module 5 discussion contribution (Friday)
Exam period				Final exam

* The completion dates for the activities are suggested completion dates to remain up to date with the course. All activities must be completed by the final day of the teaching period (11:59 PM Friday 22 April 2022).

6. Assessment tasks and feedback

Task	Knowledge & abilities assessed	Assessment criteria	% of total mark	Date of		Feedback		
				Release	Submission[2]	WHO	WHEN	HOW
Activities	Have an understanding of key recent developments and concepts in areas including astronomy, space exploration, astrobiology and related disciplines. Appreciate the interrelatedness of different scientific disciplines. Know that science is a continuing international endeavour, and that scientists are diverse in age, gender, ethnic background and nationality.	Students need to correctly answer the activity questions.	30% = 1.5 % × 20	At start of course	22/04/2022 At 11:59 PM	Facilitator	Marks and feedback available immediately after an activity attempt	Marks and feedback provided in Moodle quiz.
Discussion forum contributions	Understand the scientific method, what it means to study something scientifically, and the process of scientific discovery. Be competent in using resources on the internet to investigate scientific questions, and in preparing written reports on such investigations.	This task has 5 parts: 1. Module 1 forum 2. Module 2 forum 3. Module 3 forum 4. Module 4 forum 5. Module 5 forum	25% = 5% 5% 5% 5% 5%	14/02/22 28/02/22 14/03/22 28/03/22 11/04/22	One mark awarded for early contribution[3] 25/02/22 11/03/22 28/03/22 08/04/22 22/04/22 At 11:59 PM	Tutor	Within 7 days of the discussion forum submission date	Comments and rubric on Moodle
Written assessment	Understand the scientific method, what it means to study something scientifically, and the process of scientific discovery. Be competent in using resources on the internet to investigate scientific questions, and in preparing written reports on such investigations.	This task has 3 parts: 1. Allocation of APOD images. 2. Submit a draft of your assessment. 3. Submit your final assessment.	20% = 5% 15%	25/02/2022	 18/03/22 15/04/22 At 11:59 PM	Facilitator Tutor Tutor	 28/03/22 29/04/22	Moodle post Comments and rubric in Turnitin[4]
Final exam	Have an understanding of key recent developments and concepts in areas including astronomy, space exploration, astrobiology and related disciplines	Students need to correctly answer the questions.	25%	Examination period	Examination period	Facilitator	When requested	Via email

[2] All times and dates are given for Australian Eastern Standard Time (AEST, Sydney) or Australian Eastern Daylight Time (AEDT, Sydney). If a student is studying from overseas, it is their responsibility to check that they submit it by the due time.

[3] One mark (out of ten) is reserved for early contributions to each forum set by the relevant term: For Summer Term, at least 24 hours before the deadline; For T1, T2, or T3, within the first 5 days of the forum's release. You cannot obtain full marks for a contribution unless you make a contribution by the submission deadline stated in the course schedule.

[4] Marking rubrics for both the draft and final version can be found on the Moodle site for this course.

7. Additional resources and support

Textbooks	No prescribed text
Required readings	Will be made available on Moodle
Additional readings	If students want a textbook for the course (not required), the book *The Cosmic Perspective* 7e by Bennett, Donahue, Scheider & Voit. The text can be obtained: 1) From the UNSW Bookshop, 2) Online from Pearson Australia as an eBook ($60) (hardcopy is no longer available), or 3) UNSW library in the High Use Collection.
Recommended internet sites	Will be made available on Moodle

8. Required equipment, training and enabling skills

Equipment required	No equipment is required other than a computer.
Enabling skills training required to complete this course	ELISE It is highly recommended that you complete the Moodle module on academic integrity before submitting assessments for this course. Plagiarism and contract cheating have been a problem with previous cohorts. These cases have been found and acted upon. Please ensure that you are aware of the University's expectations around academic integrity.

9. Course evaluation and development

Student feedback is gathered periodically by various means. Such feedback is considered carefully with a view to acting on it constructively wherever possible. This course outline conveys how feedback has helped to shape and develop this course.

Mechanisms of review	Last review date	Comments or changes resulting from reviews
Major course review	T1 2021	In prior terms, an essay was the capstone assessment. This was changed to the written assessment to increase student motivation and engagement. One of the assessment items was removed.
myExperience	T2 2021	Following recommendations from students, stricter timelines on providing feedback for assessment are being implemented.
Other	T3 Summer	Smart Sparrow use at UNSW was discontinued. All activities that were hosted in Smart Sparrow were migrated to Moodle as quizzes.

10. Administration matters

Expectations of students	Even though this course is completely online the assumption is that students will spend the same amount of time working on it as a face-to-face first year course. Students should spend approximately 8 hours a week engaging with the online materials and a similar amount of time in self-directed study of the subject.		
Assignment submissions	All submission times are in Australian Eastern Standard Time (AEST, Sydney) or Australian Eastern Daylight Time (AEDT). There is a 5% penalty for each day the written assessment draft and final version are late. Submissions 5+ days late (120 hours past the deadline) *will not be marked*. This is applied using the time Moodle shows the assignment was submitted (in Turnitin). Students should submit well in advance of the submission deadline as the Moodle can slow down due to heavy usage at the due time. **If a student experiences any difficulty submitting an assignment through Moodle, they must email a copy of the assignment to the course facilitator before the assignment is due with a report of what went wrong (so that we can fix it).** The activities are due to be completed by the final day of the teaching period. Students will not be able to attempt the activities after this date. Students may contribute discussion questions and answers to the module discussion forums for the entire two-week period that the discussion is active for. One mark out of ten will be awarded for each module discussion to students who make a contribution within the first week of the discussion being open (ending at 11:59 PM Friday). This will be applied in Moodle. No marks will be awarded for questions posted in the final 24 hours of the discussion period. Answers can be posted up till the deadline. If you are not able to submit one of the assessments for reasons beyond your control, you should submit a special consideration request with supporting documentation.		
Occupational health and safety[5]	OH&S is very important. Familiarise yourself with any potential risks encountered while completing this course.		
Assessment procedures UNSW assessment policy[6]	The UNSW special consideration information can be found here.		
Equity and diversity	Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course facilitator prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (9385 4734 or http://www.equity.unsw.edu.au/disabil.html, http://www.studentequity.unsw.edu.au/). Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.		
Student complaint procedure[7]	**School contact** A. Prof. Elizabeth Angstmann First year Physics Director e.angsmtann@unsw.edu.au Or Prof. Adam Micolich, Director of Teaching, Physics adam.micolich@unsw.edu.au	**Faculty contact** Deputy Dean Education A. Prof. Alison Beavis a.beavis@unsw.edu.au	**University contact** Student Conduct and Appeals Officer (SCAO) within the Office of the Pro-Vice-Chancellor (Students) and Registrar. Telephone 02 9385 8515, email studentcomplaints@unsw.edu.au University Counselling and Psychological Services[8] Tel: 9385 5418

[5] UNSW OHS Home page
[6] UNSW Assessment Policy
[7] UNSW Student Complaint Procedure
[8] University Counselling and Psychological Services

11. Academic integrity, referencing and plagiarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at student.unsw.edu.au/referencing.

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage.[9] At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity and plagiarism can be located at:

- The Current Students site student.unsw.edu.au/plagiarism, and
- The ELISE training site subjectguides.library.unsw.edu.au/elise.

The Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: student.unsw.edu.au/conduct.

[9] International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.