



The Physics and Astronomy Department at Western welcomes you to the Academic Year 2020/2021 edition of

Astronomy 1021: General Astronomy

The syllabus to follow tries to convey how I intend to cope with the sudden paradigm shift towards online learning. Course delivery unfortunately is hampered by the need to fill numbers into transcripts, often treated as the main purpose of higher education (but luckily completely ignored by employers and, more recently, even professional schools as they state “we don’t need people who know how to write tests, we need people with problem solving skills”). To that end, please refer to the Evaluation Summary of the Syllabus, outlining the marking scheme to which all Physics and Astronomy courses adhere; if you find the current uncertainty unsettling you may consider postponing the course by a year or plan to take Astronomy A2021A: Life in the Universe and Astronomy 2022B: Origin of the Universe instead in an upcoming year, then as Discovery Credits available to you (in those courses you get exposed to the most fundamental questions about life and the Universe you’ll ever encounter without worries about marks).

Course Outline — General Comments

A course outline gives you an overview of the course, in particular (1) its content, (2) its evaluation schemes and (3) the rules. It is required at Western University to provide you with a fully accountable product with maximum fairness and equal treatment of all students participating in the course. In this, I adhere to Immanuel Kant's categorical imperative, which you find quoted sometimes in this form: *Never do for one what you are not willing to do for all!*

Western requires all Course Outlines to be filed with the Dean's office by the first day of class. They obviously don't read this material, but if a student disputes the application of any rule in a course, the Dean's office will check what the syllabus states.

When we implement a novel course component or refine an existing one, or, like in the academic year 2020/2021, deal with unprecedented shifts in the educational landscape, then an initially developed set of rules may not meet the objectives as hoped. To remedy this concurrent with the current delivery of the course, syllabus rules may have to be revised or supplemented. **Rules affected in this way will appear in the Course Outline for the current year in pink, the same colour in which this sentence is highlighted.** We will make every effort to avoid a negative impact on any student's learning experience caused by rule changes after the first day of class. We will disclose the added text to the Dean if a challenge is based on a provision added in pink. Based on past experience, we are confident that we will meet everyone's expectations of fairness in such cases.

Course Team Access

For a large online course to be conducted successfully, a large number of staff on campus get involved. Most of these work in the background, such as secretarial staff, technical staff, Institutional Technology Services staff, and Teaching Assistants. We have organized this team such that you will be in contact with us via the following meeting points, each designed for a particular context and accessible through a particular communication channel.

Western University also requires us to keep a record of all official course correspondence for one year after the completion of the course. Official course correspondence in your A1021 course is defined as correspondence received through these meeting points, which are embedded within your OWL website. Messages sent through any other channel, particularly messages sent via email or phone messages are not retained, may not be answered, and are not considered official communications regarding this course. Even if you receive a response, please be advised that such responses might be inaccurate and do not supersede statements made in the course syllabus or through the three official meeting points.

If communications with students result in amendments to the course syllabus, these are provided in Announcements on your A1021 OWL.

► Instructor

Dr. M. Zinke–Allmang (working from home during 2020/2021 academic year).

Meeting Point I: OWL Astronomy 1021 → Messages → Compose Message: To Zinke–Allmang, Martin (mzinke)

Note: Messages sent this way are **not visible** to other students.

When to post a question through this meeting point? When the content of your message requires privacy and requires attention outside the rules and regulations outlined in the course syllabus. For example, you would use this meeting point after you contacted a Dean’s Office counsellor with valid documentation concerning illness or similar adverse developments that we have to accommodate for beyond what the pertinent section in the Syllabus outlines.

If the question does not require privacy you may be redirected to the other meeting point; if the question is addressed in the Syllabus, you will be redirected to the pertinent folder. Course related questions received via regular UWO email will not be answered but you will be asked to post in Sakai since we need a permanent record for such communications.

► Teaching Assistant for Administrative and Content Questions

One or several MSc and/or PhD candidates in Physics and Astronomy will serve in this role. You communicate with the Teaching Assistants via:

Meeting Point II: OWL Astronomy 1021 → Forums → Post New Thread or click on Thread, then click on Reply

When to communicate through this meeting point?

(1) *For administrative questions:* If the issue is of general interest and your message does not require personal information, you will use the discussion board in OWL. Posted messages are answered on a regular basis and the answers, accessible to all, become part of the course outline. Please consult previously uploaded questions/answers **before** posting a new thread: if it has been asked already, the TA may not answer at all, which implies “see above.”

(2) *For content questions:* If you have a content question, for example regarding posted Unit slides or a passage in the textbook. Posted messages are answered on a regular basis. Please consult previously uploaded questions/answers **before** posting a new thread. If it has been asked already, the TA may not answer at all, which implies “see above.”

Required Course Material

- **Textbook and/or MasteringAstronomy access code (available in various packages at the Western Bookstore)**

“The Essential Cosmic Perspective” by Bennett, Donahue, Schneider & Voit (Pearson; 8th Edition)

Packages: The Book Store at Western has three packages available ... please purchase only one of them.

The content is the same in all packages; the options are provided simply to cater for your preferences – whether or not you want a hard copy of the textbook, and if you want a hard copy whether you want a traditional bound textbook or whether you would prefer the loose–leaf version. Note that the Book Store policy is to mark one option as “mandatory” and the other options as “alternative” texts – but, somewhat confusingly, that does not mean you need to buy the option marked “mandatory”.

Option 1: Essential Cosmic Perspective (traditional bound text book) plus MasteringAstronomy with eText

Option 2: Essential Cosmic Perspective (loose–leaf version) plus MasteringAstronomy with eText

Option 3: MasteringAstronomy with Pearson eText

Note that you must have one of these options to complete your homework assignments through MasteringAstronomy.

There is no such thing as a “used copy” of MasteringAstronomy – sorry, this is the publisher’s trick to sell new books.

Please keep this in mind if you are thinking of purchasing a used copy of the textbook (in case the seller tries to tell you otherwise).

A message from the UWO bookstore: Students can order through the Book Store’s website and the books will be shipped directly to them. Below is the link for the ebook version that the student can also purchase through the Book Store’s website.

<https://bookstore.uwo.ca/product/cebcodeid24019>

- **Access to OWL**

You need to have access to a desktop computer or laptop with internet connection. If you do not own a computer, you can use the facilities in the GenLabs. Contact ITS at Ext. 83800 (or at (519) 661–3800 off campus) for their location and hours of operation, or for any problems when connecting to OWL at:

<https://owl.uwo.ca/portal>

After entering your user id and password, you click on the course tab for your Astronomy course:

ASTRONOMY 1021 001 FW20

A1021 Organon

— Fall Term —

Course Component	Recommended Time Window	Title
Listen to this first	September 9 – September 13	Syllabus Review for the Online Course
Unit 1	September 14 – September 20	Scales Time (BBC-4) The Time Machine (BBC-4) The Age of the Universe (BBC-4)
Unit 2	September 21 – September 27	A Look at the Sky The Scientific Method (BBC-4) Ageing the Earth (BBC-4)
Unit 3	September 28 – October 4	Astronomy as a Science
Unit 4	October 5 – October 18 (time off for holiday)	Physics Concepts The Measurement of Time (BBC-4) The Physics of Time (BBC-4)
Unit 5	October 19 – October 25	Light The Speed of Light (BBC-4)
Unit 6	October 26 – November 1 (followed by Reading Week)	Formation of Solar System The Earth's Origin (BBC-4) The Moon (BBC-4) The Planets (BBC-4)
Unit 7	November 9 – November 15	Terrestrial Planets The Earth's Core (BBC-4) Plate Tectonics (BBC-4) Ice Ages (BBC-4) Mars (BBC-4) Venus (BBC-4)
Unit 8	November 16 – November 22	Jovian Planets Saturn (BBC-4)
Unit 9	November 23 – November 29 (this gives you an additional week off for Exam Preparations)	Other Solar System Objects The Kuiper Belt (BBC-4) Comets (BBC-4)

A1021 Organon

— Winter Term —

Course Component	Recommended Time Window	Title
Unit 10	January 4 – January 10	Exoplanets Exoplanets (BBC-4)
Unit 11	January 11 – January 17	The Sun The Sun (BBC-4)
Unit 12	January 18 – January 24	From the Sun to the Stars
Unit 13	January 25 – January 31	Life Cycle of the Stars The Life of Stars (BBC-4)
Unit 14	February 1 – February 7 (this gives you an additional week off for Midterm Preparations, followed by Reading Week)	Unusual Stellar Objects Relativity (BBC-4) Black Holes (BBC-4)
Unit 15	February 22 – February 28	Milky Way Galaxies (BBC-4)
Unit 16	March 1 – March 7	Galaxies
Unit 17	March 8 – March 14	Origin of the Universe The Cool Universe (BBC-4) The Universe's Origin (BBC-4) Antimatter (BBC-4) Grand Unified Theory (BBC-4) Quantum Gravity (BBC-4) The Multiverse (BBC-4)
Unit 18	March 15 – March 21	Fate of the Universe Dark Matter (BBC-4) Dark Energy (BBC-4) The Universe's Shape (BBC-4) The Vacuum of Space (BBC-4) The Graviton (BBC-4)
Unit 19	March 22 – March 28 (this gives you an additional week off for Exam Preparations, plus the Easter holidays)	Life in the Universe Extremophiles (BBC-4) The Origins of Life (BBC-4) Extra Terrestrials (BBC-4)

Astronomy 1021: Learning Outcomes

(1) General Learning Outcomes

The points below give a summary of general learning outcomes.

At the end of this course, you should be able to:

- know by name, define and characterize the main structural elements of the Universe at all scales;
- describe the origin and evolution of the Universe and objects within that Universe;
- have a good sense of relative sizes, distances and characteristic time scales of these objects;
- demonstrate a conceptual understanding of those physical processes that determine the appearance and evolution of astronomical objects and those that are relevant for interpreting astronomical observations;
- explain the scientific method, and use examples from astronomy in their appropriate cultural context; and,
- assess the uniqueness of Earth and life on Earth by comparison with other planets and properties of known planetary systems.

(2) Granular Learning Outcomes

Below you will find learning outcomes, roughly corresponding to the Units in the course. In addition, you can find Learning Goals at the beginning of each chapter in the textbook. Note that some of these learning outcomes encompass quite a bit of course material that is implicitly assumed to be understood! You will be able to define the meaning of terms *italicized* below. For the items with *how measured*, you will be able to describe how the quantities discussed are determined. In addition, you will be able to:

Unit 1

- a. define and use the terms *star*, *planet*, *solar system*, *galaxy*, and *nebula*;
- b. define distance in terms of light travel time (e.g., *light year*), and relate it to the size of the above objects;
- c. do order-of-magnitude estimates using scientific notation; define *million*, *billion*, and *trillion*
- d. describe the relative sizes of Solar System objects; define *astronomical unit*;
- e. give approximate ages of astronomical objects, **how measured**;
- f. use the 'cosmic calendar' to describe the order of events in the universe's history.

Unit 2

- a. describe your local orientation on Earth and relate it to directions in space;
- b. explain changes in the sky as viewed from different locations on Earth;
- c. define and use the terms *horizon*, *zenith*, *altitude*, and *constellation*;
- d. use concepts relating to the celestial sphere: *angular distance*, *ecliptic*, *equator*, *celestial poles*, *zodiac*;

- e. describe and explain changes in the sky over timescales of days, months, years;
- f. explain how the calendar and astronomical events are related;
- g. explain the reasons for seasonal changes on the Earth;
- h. correctly use Moon phase terminology: *new, full, waxing, waning, and first/third quarter*;
- i. use a mental model of the Sun-Earth-Moon system to explain and predict Moon phases, Moon rise/set, and eclipses;
- j. describe and explain the apparent motion of Solar System planets in the sky.

Unit 3

- a. name some advantages civilizations might have had when carefully observing and recording astronomical events;
- b. describe the observations and findings from Eratosthenes, Aristarchus and Hipparchus;
- c. describe and explain the models by Aristotle and Ptolemy;
- d. describe the role of all players in the Copernican revolution: Copernicus, Brahe, Kepler, Galileo;
- e. reproduce, understand and explain Kepler's laws;
- f. describe the *scientific method* and *Occam's Razor*;
- g. explain the role of *falsifiability* and change in scientific thinking;
- h. explain the use of the terms *theory, law* in science;
- i. distinguish between science and pseudoscience.

Unit 4

- a. define and use the terms *speed, velocity, acceleration, force, mass, energy, momentum, angular motion, and angular momentum*;
- b. explain Newton's Laws and how they relate to astronomical situations; illustrate each of them with an example;
- c. give some everyday examples of conservation laws;
- d. define *inverse-square law*;
- e. formulate and explain the Universal Law of Gravitation;
- f. explain Kepler's Laws and their implications for the Solar System;
- g. define and use the terms *semi-major axis, eccentricity, and inclination* as they relate to orbits.

Unit 5

- a. define *angular resolution* and how it relates to wavelength and telescope size; explain how adaptive optics, interferometry are used to increase resolution;
- b. explain the difference between *reflecting* and *refracting* telescopes;
- c. explain why telescopes that work at different wavelengths look different;
- d. explain the reasons for telescope locations;
- e. describe the different ways in which light and matter can interact: *reflection*,

scattering, transmission, absorption, and emission;

- f. define and use the terms *wavelength, velocity, and frequency* and explain the relationship between these quantities;
- g. name the components of the *electromagnetic spectrum* in wavelength order;
- h. give order-of-magnitude wavelengths for different types of EM radiation;
- i. correctly use terminology including *atom, molecule, electron, proton, and photon*;
- j. explain the fundamental interactions of light and matter at the particle scale, and illustrate by means of a schematic energy level diagram;
- k. understand energy levels in atoms and their relationship to spectral lines;
- l. describe the difference between *absorption, emission, and continuum spectra*;
- m. describe how the spectrum of an object relates to its temperature;
- n. use the Kelvin temperature scale to describe objects in the universe, **how measured**;
- o. define *Doppler shift* and its use in astronomy, **how measured**;
- p. use the *inverse-square law* to relate *apparent brightness and luminosity*.

Unit 6

- a. describe basic factors about the Solar System: constituents and their orbits, mass, location in the Milky Way, **how measured**;
- b. give the age of the Solar System to two significant figures;
- c. explain the evidence for the inferred age of the Solar System;
- d. do simple *radioactive decay* calculations;
- e. explain the *nebular hypothesis* and how it relates to Solar System properties;
- f. explain how *cratering* properties indicate ages;
- g. describe the patterns of motion among the large bodies of the Solar System.

Unit 7

- a. name the terrestrial planets and their moons; give their masses and orbital semi-major axes (relative to that of the Earth) to one significant figure;
- b. explain the steps in terrestrial planet formation;
- c. describe two major geological features of each terrestrial planet;
- d. explain the reasons for the different surface features of the terrestrial planets;
- e. describe the role of internal heating in producing planetary surface features;
- f. list the main constituents and approximate densities of the terrestrial planets' atmospheres;
- g. explain the *greenhouse effect* and the concept of *feedback*; list the causes of climate change;
- h. differentiate between the greenhouse effect and the ozone hole on Earth.

Unit 8

- a. name the Jovian planets and give their approximate masses and orbital semi-major axes (relative to that of the Earth) and compositions; compare their overall properties to

those of the terrestrial planets;

b. describe the steps in Jovian planet formation and how it differs from terrestrial planet formation;

c. name the major Jovian moons ($> 10^{22}$ kg) and some of their distinguishing characteristics;

d. explain the reasons for the appearance of different colours on the Jovian planets;

e. explain the expected lifetime of ring systems.

Unit 9

a. distinguish between *asteroids*, *comets*, *dwarf planets*, *Kuiper belt* objects by composition and location;

b. explain how these bodies differ from planets;

c. describe the gravitational influence of the planets on small bodies;

d. list reasons why Pluto should be considered a Kuiper belt object;

e. characterize the asteroid impact hazard on Earth and name two famous past impacts;

f. distinguish between *meteoroid*, *meteor*, *meteorite* and explain how these objects are used to study the Solar System.

Unit 10

a. explain how the *transit and radial velocity methods* of detecting extrasolar planets work;

b. explain what is meant by selection effects;

c. give an approximate timescale for the discovery of extrasolar planets and an order-of-magnitude number of known planets;

d. describe the properties of the extrasolar planets discovered so far (mass, orbital size);

e. explain why some of these properties were surprising and discuss the explanations;

f. describe the Kepler mission's rationale and expected results.

Unit 11

a. give the main properties of the Sun (size, mass, composition, temperature), **how measured**;

b. discuss arguments against chemical and gravitational energy powering the Sun;

c. describe the *photosphere* and *convective zone* of the Sun, and know what causes *granulation*;

d. describe the Sun's *chromosphere*, *corona* and *solar wind*;

e. describe the Sun's cycle of activity;

f. describe different transient events on the Sun such as *sunspots*, *prominences*, *flares* and *coronal mass ejections* and their influence on the Earth;

g. explain the role of magnetic fields in the *sunspot cycle*;

h. explain what *hydrostatic equilibrium* means;

- i. distinguish between *fission and fusion*;
- j. explain the concept of *nuclear binding energy*;
- k. explain what $E = mc^2$ has to do with the Sun or stars;
- l. describe the *solar neutrino problem* and its solution.

Unit 12

- a. give the range of stellar properties in mass, luminosity, and temperature, compared to the Sun, **how measured**;
- b. explain how stellar distances are measured;
- c. explain the difference between luminosity and apparent brightness;
- d. determine the change in apparent brightness that would result from changing the distance to an object of constant luminosity; identify the information needed to determine the luminosity of a star;
- e. estimate the surface temperature of a star from its colour; explain how one can measure the surface temperature of a star from observations of its spectrum;
- f. know what the spectral classification (OBAFGKM) means and reproduce it in order;
- g. describe the information we can get from binary stars and star clusters;
- h. explain what is plotted in a *Hertzsprung-Russell diagram* and how it is used;
- i. define and identify on an HR diagram the regions where we find the *main sequence*, *giant branch*, *white dwarfs*;
- j. estimate the mass of a main sequence star from its location in an HR diagram.

Unit 13

- a. define the term *interstellar medium* and explain what the ISM is made of;
- b. explain where star formation occurs and how long it typically takes;
- c. explain why star formation is difficult to study;
- d. describe the observational signatures of star formation;
- e. describe the role of disks and angular momentum in star formation;
- f. describe the distribution of stellar masses and its implications;
- g. explain what is meant by a *brown dwarf*;
- h. describe how mass and luminosity determine a star's lifetime;
- i. explain what *shell burning* is and when it happens;
- j. explain why stars leave the main sequence;
- k. describe the different post-main-sequence changes in stars of different mass;
- l. give approximate timescales for the stages in stars' lives;
- m. describe how massive stars give rise to *supernovae*;
- n. describe how mass transfer in a close binary system can alter the stars' life histories.

Unit 14

- a. define *white dwarf*, *neutron star*, *black hole* and give their approximate mass and size;

- b. explain the concept of *degeneracy pressure* and how it relates to these objects;
- c. identify which type of star ends up as which remnant;
- d. explain why *pulsars* are thought to be neutron stars;
- e. explain what a *white dwarf supernova* is and why they are important;
- f. state a few popular misconceptions about black holes, and explain why they are misconceptions.

Unit 15

- a. list the basic properties: size, mass location, type, rotation period, constituents, **how measured**;
- b. give the Sun's location and explain how it is determined;
- c. explain *galactic recycling* and how this process can be studied with multi-wavelength observations;
- d. describe the properties of the different populations of stars in our Milky Way and explain how they are related to the Milky Way's formation history;
- e. describe what a rotation curve measures and how it provides evidence for *dark matter*;
- f. discuss the evidence for a central black hole in the Milky Way.

Unit 16

- a. identify the major types of galaxies and how they differ, how they are grouped in space;
- b. list some explanations for differences between the types;
- c. explain how distances to galaxies are determined;
- d. explain the concept of *lookback time*;
- e. describe the properties of *quasars* and other *active galactic nuclei*;
- f. explain the relationship between galaxies and their central black holes;
- g. describe the evidence for the expanding universe;
- h. define *Olbers' Paradox* and explain its cosmological resolution;
- i. explain *Hubble's Law* and how it does not imply a central expansion point;
- j. state and explain the *cosmological principle*;
- k. explain why there is a *cosmological horizon*;
- l. describe the relation between the universe's expansion rate and its age.

Unit 17

- a. explain what is meant by *Big Bang theory* and list some evidence for it;
- b. define and use the term *cosmic microwave background*;
- c. give the relationship between time, energy, and temperature in the early universe;
- d. describe what happened (and approximate timescales) for the various eras in the early universe; arrange the major epochs of the early universe in order of increasing time.

Unit 18

- a. explain the effects of gravity on the expansion;
- b. define the terms *dark matter* and *dark energy*;
- c. list at least two pieces of evidence for dark matter;
- d. describe the evidence for dark energy;
- e. list the candidates for each phenomenon and their prospects for detection;
- f. explain the possible fates of the universe and how these relate to the matter and energy densities.

Unit 19

- a. discuss the terms in the *Drake equation* and how well they are known;
- b. describe the *Fermi paradox* and its possible solutions;
- c. define *SETI* and list some arguments in favour of and against it; and
- d. list requirements for life and where these are found in the Solar System.

Evaluation Summary

Part I: Unit 1 – 9	Available during Fall Term 20/21	Component Weight	
Unit Content Review Quizzes 1 – 9	Sept 9, 2020 – Dec 9, 2020 (always from Noon to Noon)	Duration 15 min * 10 Questions	cumulative need 20 for 4 %
MasteringAstronomy Quizzes MA1 – MA5	see: File 32_MateringAstronomy quizzes		Best 4 6 %
In Our Time broadcast Quizzes U1 – U9 (19 recordings available)	Sept 9, 2020 – Dec 9, 2020 (always from Noon to Noon)	Duration: 1 hour * 4 Questions	cumulative need 40 for 6 %
Exam Component I ** (U1 – U5)	Dec 11, 2020 – Dec 22, 2020 (always from Noon to Noon)	Duration: 1 hour 35 Questions	17 %
Exam Component II ** (U6 – U9)	Dec 11, 2020 – Dec 22, 2020 (always from Noon to Noon)	Duration: 1 hour 36 Questions	17 %
Part II: Unit 10 – 19	Available during Winter Term 20/21	Component Weight	
Unit Content Review Quizzes 10 – 19	Jan 11, 2021 – April 12, 2021 (always from Noon to Noon) ***	Duration 15 min * 10 Questions	cumulative need 20 for 4 %
MasteringAstronomy Quizzes MA6 – MA10	see: File 32_MateringAstronomy quizzes		Best 4 6 %
In Our Time broadcast Quizzes U10 – U19 (20 recordings available)	Jan 11, 2021 – April 12, 2021 (always from Noon to Noon) ***	Duration: 1 hour * 4 Questions	cumulative need 40 for 6 %
Exam Component III ** (U10 – U14)	April 14, 2021 – April 30, 2021 (always from Noon to Noon)	Duration: 1 hour 35 Questions	17 %
Exam Component IV ** (U15 – U19)	April 14, 2021 – April 30, 2021 (always from Noon to Noon)	Duration: 1 hour 35 Questions	17 %

* The Teaching Support Centre at Western advised instructors as follows:

“Arranging Accommodated Exams for Students with Disabilities (Fall 2020)

For online timed assessments:

Instructors are very strongly encouraged to employ the principles of Universal Instructional Design (i.e. providing 4 hours to all students to complete a 2-hour assessment) to avoid the need to accommodate students with disabilities. This is best practice.”

I will follow this advice for Unit Content Review Quizzes (thus available 30 minutes each) and In Our Time Broadcast Quizzes (thus available 2 hours each).

** Makeup privileges granted only if documentation is provided showing no availability for the entire exam period.

*** Recognizing the pressure students face in FW20/21 due to the pandemic (and related changes by the University to the Winter term), I make available UCRQs and IOTBQs for the Winter term with an earlier start time (some time between December 26 and December 30).

The Department of Physics and Astronomy may, in exceptional cases, adjust the final course marks in order to conform to Departmental policy.

Unit Content Review Quizzes (UCRQ)

We suggest to complete Unit Content Review Quizzes once the material of a Unit has been studied, i.e., the mp3 Recordings of a Unit (utilizing the pertinent Powerpoint slides and Demonstration Videos) have been attended and the pertinent chapter in the textbook has been read.

- Number of Quizzes:

9 Unit Content Review Quizzes are provided during the Fall term (corresponding to Units 1 to 9 of the course material), and

10 Unit Content Review Quizzes are provided during the Winter term (corresponding to Units 10 to 19 of the course material)

called UCRQ-1 through UCRQ-19 in Tests&Quizzes of your A1021 OWL site.

- Content of Quizzes:

Each Quiz contains 10 questions (selected randomly from a larger pool of questions for this Unit). As therefore every student will see a different set of questions, we state that these are not suitable as rehearsal material for the examinations in this course; separate Rehearsal material is provided for this purpose.

- Dates available:

Each quiz is available throughout the class-part of the term, i.e., they do not extend into Study Days or the subsequent exam period. For details on dates, please refer to the file [30_Evaluation_General](#) of the Syllabus.

Each Quiz will be accessible from Noon (12:00) on the date it opens until Noon (12:00) the date it closes.

Note: Noon is midday, not midnight!

- Other quiz details:

You receive one point for each correct answer. You have only one attempt, so be careful not to open the wrong quiz!

- Evaluation:

Each question in each quiz counts as 1 point (correct) or 0 points (incorrect). Thus, in the Fall term a maximum of 90 points can be reached, and in the Winter term a maximum of 100 points — your cumulative point value each term I call X. The threshold you need to reach for a full course component mark is called T. The course component contributes Z% each term to your Final Course mark (for the value of T and Z, please refer to file [30_Evaluation_General](#) of the Syllabus). So, at the end of each term, we calculate the value of the pertinent OWL Gradebook column (Y) as: $Y = Z$ if $X \geq T$ and $Y = X*Z/T$ if $X < T$; rounded to one decimal point.

For further details on course component evaluations, please refer to the file [30_Evaluation_General](#) of the Syllabus.

- General Comment: **Check all your scores in the Gradebook of OWL at least on a weekly basis**

If there is a discrepancy, you must notify us within one (1) week of the completion of a Quiz as ITS does not like to backtrack farther than that. That is, **all marks and points posted in the Gradebook are considered final one week after posting.**

We will not consider any adjustments for whatever reason. Each quiz is available for essentially the entire term and can be completed from a laptop/computer anywhere on the planet, even when required to self-isolate. If you miss such a significant fraction of a course, we recommend that you withdraw and retake the course the next time it is offered.

Note that you may have to update software, such as your version of JAVA. Try first, if it doesn't work, please contact the ITS Helpdesk at Ext. 83800 (off-campus at 519 661 3800).

Important disclaimer: *Counsellors in the various Deans' offices do not approve accommodations. They only validate documentation you submit with respect to missed course components and confirm this in your student file online. It is your obligation to contact course coordinators to discuss arrangements, but only if, as a result, an accommodation is warranted, that is in particular, the time missed includes the entire window for the affected course component.*

MasteringAstronomy Assignment Quizzes

You have to complete MasteringAstronomy Assignments following the provided schedule (as these are NOT available throughout the term); please note that this unfortunately forces you to follow the material in a certain rhythm (you can move faster with your Unit studies, but you cannot move slower to not lose scores in the MasteringAstronomy assignments). In turn, these quizzes are timed towards the end of each anticipated time window, and you need only complete 4 of 5 each term.

Note, to complete the quiz embedded in each assignment, you must first join the course on the MasteringAstronomy site, using the code which came with your textbook or which you purchased separately. *For details, including the Course ID, see the appendix below with the pertinent email from the Pearson Representative.* However, more detailed is the Pearson-provided pdf-file available in a separate tab called "Mastering Astronomy Access".

- Number of Quizzes:

5 MasteringAstronomy Quizzes are provided each during the Fall term, and the Winter term, typically one every two weeks

- Content of Quizzes:

Each MasteringAstronomy Quiz relates loosely to the material listed in the attached table. Each quiz contains a certain number of problems to be solved within an allocated time limit. The correct answers and marks for each quiz will be released ON THE MASTERINGASTRONOMY website after the quiz closes.

- Dates available:

Each MasteringAstronomy Quiz is available from Tuesday, at 10:00 (10 am) to the following Monday, at 17:00 (5 pm), i.e. a six day period unless announced otherwise.

MasteringAstronomy Quiz	Best attempt after completing	Start Date available	End Date available
1	Units 1 and 2	Sep 22	Sep 28
2	Units 3 and 4	Oct 6	Oct 12
3	Units 5 and 6	Oct 20	Oct 26
4	Unit 7	Nov 17	Nov 23
5	Units 8 and 9	Dec 1	Dec 7
6	Units 10 and 11	Jan 19	Jan 25
7 ***	Units 12 and 13	Feb 9	Feb 22
8	Units 14 and 15	Mar 9	Mar 15
9 ***	Units 16 and 17	Mar 23	Mar 29
10 *	Units 18 and 19	Apr 5	Apr 13 **

* Quiz 10 is not marked in FW20/21

** We allow Quiz 10 to run into the Study Day to stay consistent with the Monday to Tuesday pattern; this is permissible because this quiz is not marked.

*** Pearson has notified us that their platform will not be accessible due to maintenance on February 20 and March 27, each day from 1 am to 9 am ET. Please take this into account when planning completion of Assignment 7 and 9.

- Other MasteringAstronomy quiz details:

You receive a mark for each quiz as shown in the MasteringAstronomy Gradebook (this is not the same as the OWL Gradebook). We intend to transfer marks twice to the OWL Gradebook in December and in April; therefore, please check your marks in the MasteringAstronomy Gradebook regularly.

- Evaluation:

You need to complete 4 MasteringAstronomy quizzes in the Fall term and 3 MasteringAstronomy quizzes in the Winter Term. If you complete all 5 (4) marked quizzes in a term, the best 4 (3) will count. Each quiz is weighted equal to the others.

For further details on course component evaluations, please refer to the file [30_Evaluation_General](#) of the Syllabus.

- General Comment: Check all your scores in Mastering Astronomy at least on a biweekly basis

If there is a discrepancy, you must notify us within one (1) week of the completion of a Quiz as we do not backtrack farther than that. That is, **all marks and points posted in the Gradebook are considered final one week after posting.**

We will not consider any adjustments for whatever reason. Each quiz is available for almost a week and you may miss one each term without penalty. They can be completed from a laptop/computer anywhere on the planet, even when required to self-isolate. Once you miss a significant fraction of the course (at least two six-day periods in a single term), we recommend that you withdraw and retake the course the next time it is offered.

Note that you may have to update software, such as your version of JAVA. Try first, if it doesn't work, please contact the ITS Helpdesk at Ext. 83800 (off-campus at 519 661 3800).

Important disclaimer: *Counsellors in the various Deans' offices do not approve accommodations. They only validate documentation you submit with respect to missed course components and confirm this step in your student file online. It is your obligation to contact the course coordinator to discuss pertinent arrangements, but only if, as a result, an accommodation is warranted.*

APPENDIX:

Information provided by the Publisher/MasteringAstronomy platform administrator

I have created one Mastering course that will function for BOTH of your A1021 sections.

Please sign in with your account at www.pearson.com/mastering (your Pearson username is your uwo email).

You will see your new course there. Your new courseID is: zinke-allmang21788

In Our Time Broadcast Quizzes (IOTBQ)

As a degree holder of a Canadian University, it is assumed that you can follow conversations on a subject matter you have studied. What this means, however, is usually not evident when you take a breadth course. For this purpose, on various subjects of broader interest pertaining to the course material we cover in Astronomy 1021, we provide you with a set of mp3 Recordings of the BBC-4 programme *In Our Time*, moderated by Melvyn Bragg (<https://www.bbc.co.uk/programmes/b006qykl/episodes/guides>)*. Your participation is recorded through a set of questions accessible with each recording. The BBC-4 broadcasts usually last for 30 to 45 minutes, the quiz questions will be available longer; thus we recommend you open the quiz, briefly review the four questions before enjoying the programme Melvyn Bragg and his guests provide.

*On this website, you also find the rules for use of the *In Our Time* BBC Radio 4 broadcasts; please note, that these apply even if you download a broadcast from your OWL site.

- Number of Quizzes:

19 *In Our Time* Programme Quizzes are provided during the Fall term (corresponding to Units 1 to 9 of the course material), and

20 *In Our Time* Programme Quizzes are provided during the Winter term (corresponding to Units 10 to 19 of the course material).

The quizzes are labeled IOTBQ-U*, where U* stands for the Unit number, followed by the title of the broadcast. These are provided in Tests&Quizzes of your A1021 OWL site.

- Content of Quizzes:

Each quiz contains 4 questions (selected randomly from a larger pool of questions for this broadcast)

- Dates available:

The quizzes are available throughout the class-part of the term, i.e., they do not extend to Study Days/exam periods. For details on dates, please refer to the file [30_Evaluation_General](#) of the Syllabus

- Other quiz details:

You receive one point for each correct answer. You have only one attempt, so be careful not to open the wrong quiz! The quiz is available longer than the broadcast lasts, however, do not delay the broadcast for more than 10 minutes. Also, we **do not** recommend to listen to the broadcast first, then start the quiz, as many questions refer specifically to something (e.g., a number) mentioned in the broadcast and are impossible to memorize for later.

- Evaluation:

Each question in each quiz counts as 1 point (correct) or 0 points (incorrect). Thus, in the Fall term a maximum of 76 points can be reached, and in the Winter term a maximum of 80 points — your cumulative point value each term I call X. The threshold you need to reach for a full course component mark is called T. The course component contributes Z% each term to your Final Course mark (for the value of T and Z, please refer to file [30_Evaluation_General](#) of the Syllabus). So, at the end of each term, we calculate the value of the pertinent OWL Gradebook column (Y) as: $Y = Z$ if $X \geq T$ and $Y = X*Z/T$ if $X < T$; rounded to one decimal point.

For further details on course component evaluations, please refer to the file [30_Evaluation_General](#) of the Syllabus.

- General Comment: **Check all your scores in the Gradebook of OWL at least on a weekly basis**

If there is a discrepancy, you must notify us within one (1) week of the completion of a Quiz as ITS does not like to backtrack farther than that. That is, **all marks and points posted in the Gradebook are considered final one week after posting.**

We will not consider any adjustments for whatever reason. Each quiz is available for essentially the entire term and can be completed from a laptop/computer anywhere on the planet, even when required to self-isolate. Once you miss such a significant fraction of a course (essentially half of it in the case of A1021), we recommend that you withdraw and retake the course the next time it is offered.

Quizzes can be completed at any computer connected to the internet, including at home. Broadcasts can also be listened to with any computer connected to the internet and equipped with suitable speaker technology. If you require technical assistance, please contact the ITS Helpdesk at Ext. 83800 (off-campus at 519 661 3800).

Important disclaimer: *Counsellors in the various Deans' offices do not approve accommodations. They only validate documentation you submit with respect to missed course components and confirm this in your student file online. It is your obligation to contact course coordinators to discuss arrangements, but only if, as a result, an accommodation is warranted, that is in particular, the time missed includes the entire window for the affected course component.*

Examinations

We operate the course as two non-cumulative halves, the first half during the Fall term and the second half during the Winter term. During the December and April exam periods, we run two exams each, to cover the course material in blocks of 4 to 5 Units. Each of the four examinations is available to you throughout its exam period; this allows you to accommodate your preparation flexibly, taken the schedule of your other exams into consideration.

- Number of Examinations:

2 Exam Components during the December Examination period —
Examination I (corresponding to Units 1 to 5 of the course material), and
Examination II (corresponding to Units 6 to 9 of the course material)

and

2 Exam Components during the April Examination period —
Examination III (corresponding to Units 10 to 14 of the course material), and
Examination IV (corresponding to Units 15 to 19 of the course material)

These will be labelled Exam-I-Unit-1-5 and Exam-II-Unit-6-9 (in the December exam period), and Exam-III-Unit-10-14 and Exam IV-Unit-15-19 (in the April exam period), respectively, and will be available through the TAB Test&Quizzes on the OWL site.

- Content of Quizzes:

In each of the four examination components 34 questions count against your component mark, to be completed in 1 hour (60 minutes). Note that the questions are randomly selected from a larger pool of questions for the respective Units. Note that you will find either 35 or 36 questions in each exam. You will be responsible for 34 of these (i.e., we will treat your cumulative score as if out of 34).

- Dates available:

Each Examination component is available throughout the respective examination period. For details on dates, please refer to the file [30_Evaluation_General](#) of the Syllabus.

- Other Examination details:

You receive 1 point for each correct answer and 0 points for incorrect answers. Needless to say, you will have only one attempt, so be careful not to open the wrong examination!

Aids: this is an open textbooks exam, please have the textbook and your notes ready when starting one of the examinations in this course.

- Evaluation:

This course component contributes Z % each term to your Final Course mark (for the value of Z, please refer to file [30_Evaluation_General](#) of the Syllabus), assuming you answer correct X questions, we calculate the value of the pertinent OWL Gradebook column (Y) as: $Y = X*Z/34$, rounded to one decimal point and capped at $Y = Z$.

For further details on course component evaluations, please refer to the file [30_Evaluation_General](#) of the Syllabus.

- Reasons the Dean's office may accept for missing the final examination:

- Serious personal illness, for which you need to provide medical documentation covering the entire examination period, see [40_Small Print](#);

- Bereavement of an immediate family member;

- Religious Holiday (must be a holiday officially recognized by Western and must stretch the entire exam period. It must be filed in advance of the examination period; see the Dean's office for filing deadlines, which are usually well ahead of the examination period);

- Exam scheduling conflicts — not applicable

In each case, supporting documentation must be filed with the Office of the Dean of your Faculty. In general, if you either know in advance that you will miss an exam or you have missed an exam, do not contact your lecturer or the Departmental office: they cannot grant you permission to write a makeup exam — you must contact the Dean's counsel-

ing office of your Faculty.

- What happens after the exam?

You have two avenues to challenge your mark on the final exam or in this course: Within one week of posting and publishing the marks (in the OWL Gradebook or, for the course marks on the registrar's official site) ...

- you request a review of the exam (how this will be done will be determined by the Chair of the Physics and Astronomy Department or his/her delegate at that time), then formulate a challenge to one or more questions and provide your rationale. This you submit to the course instructor who reports back to you with a decision — or, ...

- you provide a request for a mark revision on compassionate grounds. Reasons given must severely have affected your course performance, usually in more than one course, and must be supported by documentation that has been submitted prior to the Dean's office. Again, the instructor reports back to you with a decision.

If you are not satisfied with the decision, you are allowed to carry your appeal to the next stage, i.e., the Chairman of the Department of Physics and Astronomy. We will provide to the Chair your initial request for an appeal, and all material he/she considers useful to come to a decision. Prior to proceeding with such an appeal, you may consult with the Chair or the Dean's office regarding rules that govern such appeals, as these change from time to time, often without notice provided to your instructor. While you are entitled to see your exam for one year (again, what this entails will have to be decided by the Chair of Physics and Astronomy) after the exam has been written, timely action is needed if you feel that the mark does not properly reflect your performance in the course.

The Small Print

Special mention for online courses in Academic Year 2020/2021

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple choice exam preparation and writing, textbook reading, and more. Individual support is also available.

Students who find themselves in emotional and/or mental distress should refer to Mental Health@Western (http://www.health.uwo.ca/mental_health) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC at <http://westernusc.ca/services>.

Changes to Western Bookstore Services for 2020/2021

To accommodate courses that are being offered online, and students that are not residing in London, the Bookstore will offer the following services for the Fall term:

- Online ordering of physical (paper) books and/or Custom Course Materials (e.g., lab manuals) through the Bookstore website. Items can be shipped to students directly (online order at bookstore webpage) if they are learning remotely.
- Students buying books on campus will have the option of some form of curbside pickup
- Obtaining commercial electronic books, to be sold through the Western Bookstore website (depending on publishers' availability).
- Converting Custom Course Materials (textbooks or lab manuals) to an electronic format. The e-books will be accessible only via the Bookstore's online platform. Students will not be able to download the content for offline access. But instructors can select certain pages to be printed out by the students.

If you have any questions or want to place an order, contact Rachel Sandieson, Course Materials Manager at rsandies@uwo.ca.

General

This file constitutes part of the Syllabus and contains two types of information:

- Information that we have to include in the Syllabus due to Senate regulations, or pertinent requests by the Dean's office or the Registrar.
- Information on bureaucratic details such as how we handle complaints, mark postings, plagiarism (cheating), student's responsibilities, medical notes, and related formalities.

Course Description

Course title: Astronomy 1021: General Astronomy

Description: A general survey of astronomy including: the Solar System and its constituents; stars, their basic properties and evolution; systems of stars including clusters; our Milky Way Galaxy and other galaxies; the universe, its past, present and future structure; astronomical instruments; topics of current interest including extrasolar planets, pulsars, quasars, and black holes.

Prerequisites: None

Antirequisites: Astronomy 1011A/B (this course has not been offered in the last four years)

Course hours: online

Units: 1.0

Complaints and Suggestions

If you have a genuine concern about something, please communicate with us. We rely on your feedback. Please contact initially the person most directly concerned; this will usually be one of the team members. If that does not work, or there is something more general bothering you, talk it over with the Chairman of the Department of Physics and Astronomy.

Where do I find my marks?

All current marks are posted and updated in a timely fashion on the course OWL website; your scores in the Mastering Astronomy Quizzes will be found on Pearson's Mastering Astronomy platform. It is your responsibility to check the listings for accuracy on a regular basis. Errors must be reported to your lecturer within one (1) week of initial posting.

The course mark will be posted on this site and/or on the official Registrar's site. It is your responsibility to check the accuracy of the official Registrar's posting.

Under no circumstances will the Department of Physics and Astronomy release marks over the telephone, nor will we issue individual replies per email with final marks. If you have a valid reason to obtain this information ahead of the official posting on the Registrar's web site, please contact us in advance.

Student's responsibilities

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Student Accessibility Services (SAS) at 661-2147 if you have any questions regarding accommodations.

Link to the policy on Accommodation for Students with Disabilities

www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_disabilities.pdf

You are responsible to contribute your share to an orderly conduct of all activities relating to this course. This includes in particular a responsibility to maintain the technical tools you are using in this course:

- **Your course OWL website**

You must access this site on a regular basis to find online course content, announcements, updated grades, and communications between students and course team about content and administrative issues. Neglect of maintaining an overview of the material on this site does not constitute a reason for exemption of any or all course related assignments. For OWL-related help, contact the ITS Help Desk at Ext. 83800, or, off campus, phone 519-661-3800.

In particular, never leave a computer alone on which you are logged into your OWL account. You will be fully responsible for any mischief others may commit on your site!

- **Data Security**

Note: all data we acquire in this course are uploaded to the Gradebook. At the end of the term, these data are downloaded into an Excel file that is maintained as the master file for this course. We retain these files for one (1) year. After that time, we may no longer be in a position to provide details on your marks to the Dean's office. This is relevant to all those who have a dispute about course marks, or request the Dean to review their marks in a summary fashion when being asked to withdraw from the University. Thus, make sure that the Final Mark, as posted on the registrar's site is correct.

We guarantee our students that none of their marks are released to any other party than the Dean's office of the student. All course marks are calculated and uploaded by the lecturer; access to your grades is limited to the lecturer and those who are assigned as Teaching Assistants in this course. These individuals have been instructed to maintain confidentiality with respect to the marks they see; they are bound to confidentiality through their employment contract with the University.

- **Laptops**

Your laptop will allow you to access OWL and the various components on this web page, in particular all the online material required to complete the course. It is your responsibility to ensure that any equipment you use

to complete tasks in this course are functioning properly. If you encounter problems with a computer, consult with the ITS HelpDesk at Ext. 83800 or, from off-campus, at 519-661-3800.

Plagiarism

Plagiarism is the University's word for cheating, and there are severe penalties involved. Please refer for the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

Thus, there are further Academic Offenses not mentioned explicitly in this Course Outline which apply.

Note that these rules apply to any form of participation in a mark-sensitive component in this course. We point out in particular one maybe less obvious case:

○ You are not permitted to login to the course OWL website with any userID / password other than your own. In particular, by submitting an answer to a quiz question online, you confirm that its content is your own work.

Absences and Medical Notes

(Policy on Academic Consideration for Student Absence)

Students have up to two (2) opportunities during the regular academic year to use an online portal to self-report an absence during the semester, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student's final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless otherwise noted in the syllabus. NOTE: Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student's final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-reported Absence are not met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. All documentation required for absences that are not covered by the Self-reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.

For policy on Academic Consideration for Student Absences, see:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf

and for the Student Medical Certificate (SMC), see:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Note that it is your Dean's responsibility to assess your documentation and formulate a recommendation for accommodation to course instructors. Once the Dean's office and the course instructor have arrived at an appropriate accommodation, you will be informed. If this accommodation includes arrangements alternative to the regular course outline, we will discuss this with the student. If the student is agreeable to these accommodations, they will be applied; if not, additional discussions between the Dean's office, the course instructor and the student will take place to resolve outstanding issues.

Conflicts due to Religious Holidays

Link to the policy on Accommodation for Religious Holidays

www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

Other useful links

Link to the website for Registrarial Services:

<http://www.registrar.uwo.ca>

Link to learning skills services at the Student Development Centre:

<http://www.sdc.uwo.ca>

Link to services provided by the University Students' Council:

<http://westernusc.ca/services/>