THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY | HKUST Summer School

PHYS 1002 – Introduction to Astrophysics and Astronomy

School:	**School of Science**
Subject Area:	**Physics**
Course Credit:	**3**
Instructor:	**CHEN Tian Wen**
Pre-requisite/co-requisite:	**Nil**

Notes:

- The syllabi provided here is for reference only and may be subject to changes and adjustments as determined by the course instructors.

PHYS1002 L1 Summer 2025

Course Syllabus

Course Title: Introduction to Astrophysics and Astronomy
Course Code: PHYS1002
No. of Credits: 3
Pre-requisite: A passing letter grade in CORE 1401 OR CORE 1402 OR CORE 1403 OR CORE 1404 OR LANG 1002 (prior to 2022-23)
Exclusion: PHYS1006, PHYS3071

Instructor

L1: Prof. CHEN, Tian Wen,
Email: twchen@ust.hk
Office Hours: Friday 4:30pm - 5:30pm

Course Description

Introduction to our Universe; observation in astronomy; origin of modern astronomy. Newton's law of motions; gravity; light, atoms and telescope. The Sun; stellar formation and evolution; main sequence stars; white dwarfs, neutron stars and black holes. The Milky way Galaxy; galaxy types and evolution; supermassive black holes at galactic centers. Foundation of modern cosmology; dark matter, dark energy and the fate of the Universe; the beginning of time.

Key Topics

PART I: Developing Perspective
Chapter 1 A Modern View of the Universe
Chapter 2 Discovering the Universe for Yourself
Chapter 3 The Science of Astronomy
PART II: Key Concepts for Astronomy
Chapter 4: Making Sense of the Universe: Understanding Motion, Energy, and Gravity
Chapter 5-6 : Light and Matter: Reading messages from the Cosmos; Telescopes: Portals of Discovery
PART III: Stars
Chapter 14: Our Star
Chapter 15: Surveying the Stars
Chapter 16-17: Star Birth and Star Stuff
Chapter 18: The Bizarre Stellar Graveyard
PART IV: Galaxies and Beyond
Chapter 19: Our Galaxy
Chapter 20-21: Galaxies and the Foundation of Modern Cosmology; Galaxy Evolution
Chapter 22-23: The Birth of the Universe; Dark Matter, Dark Energy, and the Fate of the Universe

Teaching and Learning Activities

Activities	**Format**
Lectures	1 lecture per day, 2 hours 20 minutes each
Homework	Self-practice
PRS Quizzes	Answering multiple choice (MC) questions by iPRS in lectures
Tutorial MC Quizzes	Answering MC questions by iPRS at the end of lectures
MC and Strip sequence Quiz	5 MC questions + 3 Strip-Sequence question, 45 minutes
Student-generated Question (SGQ)	Students each writes one MC question
Written Report of an Open-ended Question (OEQ)	Students each chooses one open-ended question and writes a report
Final Exam	MC + Short Questions, 3 hours

Intended Learning Outcomes

Upon successful completion of this course, students should be able to:

No.	ILOs
1	Summarize the scale and history of the universe, basic sky phenomena, the reasons for the seasons, the phases of the Moon and the causes of eclipses
2	Apply basic physical laws to calculate the motions of celestial objects
3	Describe the basic properties of light and matter, telescopes, and their working principles
4	Describe and explain the general properties of stars and how we measure these properties
5	Summarize stellar evolution and the life cycle of low, medium, and high-mass stars from birth to death
6	Summarize the endpoints of stellar evolution: white dwarfs, neutron stars, and black holes
7	Describe galactic recycling, supermassive black holes at the centers of galaxies, how we determine the key parameters such as galactic distances and ages, and galaxy evolution
8	Summarize the evidence for dark matter and dark energy and describe the cosmological principle, the big bang theory, and the evolution of the universe

Sub-competencies

Sub-competencies	Possible Breakdowns of Competencies / Descriptions of Competencies
CM02 Language Meaning	• Develop ideas clearly and fully • Organize ideas coherently from sentence to text level (in speaking and writing)
PS02 Application of Critical Thinking	• Apply evidence-based solution • Provide unbiased judgment to analyze problem
PS03 Evaluation of Information and Sources	• Identify relevant sources/information • Analyze and synthesize information from sources • Evaluate the quality of information and sources • Provide evidence-based argument • Draw conclusions by synthesizing different skills such as analytical, quantitative reasoning, and critical thinking

Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessments

Assessment Task	**Contribution to Overall Course grade (%)**	**Date/Due Date**	**Assessing Course ILOs**	**Assessing Sub-competencies**
Homework	0	N/A	1, 2, 3, 4, 5, 6, 7, 8	PS02, PS03
PRS Quizzes	5	In-class	1, 2, 3, 4, 5, 6, 7, 8	PS02, PS03
Tutorial MC Quizzes	5	In-class	1, 2, 3, 4, 5, 6, 7, 8	PS02, PS03
Multiple Choice and Strip sequence Quiz	10	2 Jul	1, 2, 3, 4, 5, 6, 7, 8	PS02, PS03
Student-generated Question (SGQ)	5	7 Jul (23:59)	1, 2, 3, 4, 5, 6, 7, 8	CM02, PS02, PS03
Written Report of an Open-ended Question (OEQ)	25	14 Jul (09:00)	1, 2, 3, 4, 5, 6, 7, 8	CM02, PS02, PS03

Final Exam	50	11 Jul	1, 2, 3, 4, 5, 6, 7, 8	PS02, PS03

Grading Rules

Homework

Homework questions will be posted at the beginning of each chapter as self-learning materials. Students are not required to hand in homework solutions. Homework solutions will be provided by the instructors about one week after each chapter concludes.

Quizzes (iPRS)

Full marks for correct answers, 1/4 mark for incorrect answers, 0 mark for no answers.

The best 80% of a student's quiz answers will be counted for the total marks of PRS and tutorial quizzes.

Marks of the PRS and MCQ quizzes conducted during the add-drop period will not be counted toward the final grade.

MC and Strip-Sequence Quizzes

A strip-sequence question requires students to arrange a provided list of items in the correct order (not necessarily chronological). Points are awarded based on the number of inversions in the sequence on a linear scale, where full marks are given if all pairs are in the correct order, and zero marks are awarded if only half of the pairs are in the correct order.

For example, if a question presents 5 items, resulting in a total of 10 pairs, the marks will be allocated as follows:

Number of pairs in correct order	Marks
5 or fewer	0%
6	20%
7	40%
8	60%
9	80%
10	100%

Student-generated Question (SGQ)

Each student should generate ONE Multiple Choice (MC) question with FIVE choices (1 correct choice + 4 wrong choices) based on the contents of the lecture notes. Students can refer to the detailed marking scheme posted on Canvas.

Written Report of an Open-ended Question (OEQ)

Each student has to submit an individual report and its topic must be chosen from one of the open-ended questions posted. Students can refer to the detailed marking scheme posted on Canvas.

Final Exam

Closed-book exam covering all chapters. There will be 40 MC questions and 5 short quantitative questions.

Students can bring three A4-size cheat sheets (6 sides together, either hand-writing notes or electronic typing notes). The cheat sheets are only for individual-base use, no copying from other students is allowed.

Final Grade Descriptors

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrates a comprehensive grasp of subject matter, expertise in problem-solving, and significant creativity in thinking. Exhibits a high capacity for scholarship and collaboration, going beyond core requirements to achieve learning goals.
B	Good Performance	Shows good knowledge and understanding of the main subject matter, competence in problem-solving, and the ability to analyze and evaluate issues. Displays high motivation to learn and the ability to work effectively with others.
C	Satisfactory Performance	Possesses adequate knowledge of core subject matter, competence in dealing with familiar problems, and some capacity for analysis and critical thinking. Shows persistence and effort to achieve broadly defined learning goals.
D	Marginal Pass	Has threshold knowledge of core subject matter, potential to achieve key professional skills, and the ability to make basic judgments. Benefits from the course and has the potential to develop in the discipline.
F	Fail	Demonstrates insufficient understanding of the subject matter and lacks the necessary problem-solving skills. Shows limited ability to think critically or analytically and exhibits minimal effort towards achieving learning goals. Does not meet the threshold requirements for professional practice or development in the discipline.

Policy on using Generative AI

Students are prohibited from using generative artificial intelligence (AI) in PRS/MCQ quizzes, or to produce any materials or content in their OEQ written report and SGQ student-generated question.

Communication and Feedback

Scores and feedback comments, if appropriate, will be posted on the Canvas course website within two weeks after the quizzes/tests/submission deadlines/exam. Students who have further questions about the scores and feedback should consult the instructor within five working days after they are posted.

Resubmission/Make-up Policy

Quizzes

Late submissions or resubmissions will not be accepted.

SGQ and OEQ reports

Marks will be deducted for late submissions according to the following formula:

For submissions that are late for N days

Score = Original Score * ($1 - 0.2 \times N$) for $N = 1, 2, 3, 4$

Score = 0 for $N \geq 5$

MC and Strip Sequence Quizzes

No makeup will be offered except for sufficiently valid reasons, such as physical illnesses (with medical certification).

Final Exam

Make up exam will be offered only for requests submitted to and approved by ARR officially.

Required Texts and Materials

Text Book:
"Cosmic Perspective": Pearson New International Edition, 7th Edition
Author: Jeffrey O. Bennett; Megan Donahue; Nick Schneider; Mark Voit

Reference Books:
"The essential cosmic perspective " Bennett, Donahue, Schneider, Voit, Sixth Edition, Pearson
"Universe", Freedman and Kaufmann, 8th edition, Macmillan
"Astronomy Today", Eric Chaisson and Steve McMillan, 8th edition, Pearson

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.