Items of Course Outlines

Course Title: Introduction to Stellar Astrophysics

Course Code: PHYS3071

No. of Credits: 3

Any pre-~~/co-~~requisites: PHYS2022

1. Instructor (s)

Name: Nidhi Pant, Contact Details: E-mail: pantnidhi@ust.hk; Tel. No.: 23587486; Office: Rm.4451

Office Hours: Book an appointment via email

2. Teaching Assistant (s)

Name: Yu Wenqi, Contact Details: E-mail wyuaz@connect.ust.hk

3. Meeting Time and Venue

Lectures

Date/Time/Venue: LA1: Wed and Fri 4:30 – 5:50 pm

Venue: Rm. 6602

Tutorials

Date/Time: T1: Wed 9:30 – 10:20 am

Venue: Rm. 6602

4. Course Description

Credit Point: 3

Pre-requisite: PHYS2022

Co-requisite: NIL

Exclusion: NIL

Brief Information/Synopsis: An introductory course in stellar astrophysics. This is a required course in the Astrophysics and Cosmology Minor Program. Basic concepts in stellar astrophysics are introduced such as stellar nucleosynthesis, composition of stars, energy generation and transfer, stellar spectra, stellar structure and evolution.

5. Intended Learning Outcomes

Upon completion of this course, students are expected to be able to:

1	Understand how the tools of physics are applied to elucidate the physical properties of stars.
2	Understand how classical and relativistic mechanics are applied to predict the static and dynamical properties of stars.
3	Understand how thermodynamics is applied to elucidate the internal structure and the evolution of stars.
4	Use understandable arguments to explain the intimate relation between observations and theoretical analyses as the scientific approach to understand the physical world.

6. Assessment Scheme

Assessment	Assessing Course ILOs
25% by classwork	1-4
10% by 1 quiz	1-4
25% by project report and presentation	1-4
40% by Final exam	1-4

7. Criterion-Referenced Grading

Grading in this course will be based on **criterion-referencing**, meaning students will be graded against a defined standard or rubric rather than being compared to other students.

8. Grading Rubrics

a. Grading rubrics for project report and presentation

Project Report rubrics:

1) Literature review and survey Prior works are acknowledged by referring to sources for theories, assumptions and findings. References are exact with author, journal, volume number, page number and year.	10 pts Full Marks Exemplary report (10): All relevant information was obtained and stated. All information from the sources was valid and correct.	Excellent : 10 Very good : 8 Good : 7 Bad : 5 Very bad: 3	Maximum: 10 pts
2) Organization Points are logically ordered, sharp sense of beginning and end.	5 pts Full Marks Points are logically ordered, sharp sense of beginning and end.	Excellent : 5 Very good : 4 Good : 3 Bad : 2 Very bad: 1	Maximum: 5 pts
3) Problem statement/motivation Clear statement of project's objectives, motivation for pursuing the project and its relevance is clearly established by relating the project with related work.	5 pts Full Marks Exemplary report (5): The project's motivation is clearly stated and relevance with current research is established.	Excellent : 5 Very good : 4 Good : 3 Bad : 2 Very bad: 1	Maximum: 5 pts
4) Teamwork Clear distribution of work done by each teammate and acknowledging the group members of their contribution.	5 pts Full Marks Exemplary report (5): The team worked well to achieve together the objectives. Each member contributed in a	Excellent : 5 Very good : 4 Good : 3 Bad : 2 Very bad: 1	Maximum: 5 pts

	valuable way to the project. Demonstrate a high value of respect and collaboration.		
5) Cohesion, clarity, and creativity The report is well organized and clearly written. Project report aptly includes the underlying physics and flow of ideas. The demonstration was imaginative and effective in conveying ideas to the reader.	5 pts Full Marks Exemplary report (5): The report demonstrates the clarity of the topic, and cohesion among different sections and uses creativity to convey the ideas to the reader.	Excellent : 5 Very good : 4 Good : 3 Bad : 2 Very bad: 1	Maximum: 5 pts
6) Research Connection of the topic to ongoing research work in the field.	10 pts Full Marks Exemplary report (10): The group demonstrated knowledge of the course content by integrating major and minor concepts in the report. The group also demonstrated evidence of extensive research effort and a depth of thinking about the topic.	Excellent : 10 Very good : 8 Good : 7 Bad : 5 Very bad: 3	Maximum: 10 pts
7) Analyzing & summarizing results Critical thinking based on evidence, analysis, synthesis and conclusion is demonstrated	10 pts Full Marks Exemplary report (10): Integrate the findings about the topic into a coherent and logical framework. Highlights the	Excellent : 10 Very good : 8 Good : 7 Bad : 5 Very bad: 3	Maximum: 10 pts

	significance and importance of results. Uses appropriate visuals such as charts, graphs, or tables. Identify patterns, trends, or relationships with the information presented. State alternative perspective for the findings.		
8) Meaningful discussion & domain knowledge All relevant information was accurately analyzed. Detailed discussion on milestones of the project topic.	10 pts Full Marks Exemplary report (10): Discussions on prospects, limitations, or potential biases in the research or results.	Excellent : 10 Very good : 8 Good : 7 Bad : 5 Very bad: 3	Maximum: 10 pts
9) Time and page management Report submitted on time. The report contains a maximum of 5 pages of the main text, double-spaced and font-size 12 points excluding figures and references. Each subtopic is allotted enough time for clarity. No regions in the report are rushed.	5 pts Full Marks Exemplary report (5): Report follows the page and content limit guidelines. Report demonstrates good time management across subsections.	Excellent : 5 Very good : 4 Good : 3 Bad : 2 Very bad: 1	Maximum: 5 pts
10) Presentation and English Diagrams or plots are used to enhance and clearly present the ideas.	5 pts Full Marks Exemplary report has: Good use of language to communicate the topic and	Excellent : 5 Very good : 4 Good : 3 Bad : 2 Very bad: 1	Maximum: 10 pts

Sentences are grammatical and free of spelling errors. Words are chosen that precisely express the intended meaning and support reader comprehension	research. Innovative and effective methods to communicate the results and findings.		

Presentation rubrics:

Criteria	Assessment	Score
Title	The title should be concise and descriptive (avoids unnecessary words).	1
Background	The background should not take more than 20 % of your presentation. The background section provides answers to the following: why it's important? what is current state of art of the topic? What is the future in the field?	3
Research statement	Cleary and explicity stated	5
Research methods	Physics clearly explained, make references to physical concepts learnt in PHYS3071: Most Important part of presentation	5
Results	Very important in a presentation: clear plots and explanations. Discussions about limitations, progress/challenges, and inferences	5
Conclusion	Summarizes major findings, discuss future implications, alternative explanations	3
Teamwork and delivery	Divide time among teammates. Keep your voice clear and maintain eye contact with the audience. Manage pace and time of presentation	3

Slide design and presentation	Each slide (with the exception of the title slide) should have a strong headline. includes clear captions/labels/symbols to make slides easier to follow. Minimize the use of bullet points. Use good quality plots and credits sources. Aim approximately ~1 slide per minute. Uses slide design with consistent look and feel. Presents slides that are readable from a distance.	2
Engagement	Presenter engages with the audience (ex. asking or answering questions, acknowledges audience presence).	2
Total score- peer question		29
Extra 1 point for students in each group who answered most question		

b. Grading of classwork, quiz and final exam questions:

Simple grading rubric for classwork grading: If the final value and derivation steps are correct, award full points.

Examine the derivation of errors and categorize them as

Minor (deduct 1) , **Moderate (deduct 2)**, or **Major (deduct 3).**

9. Final Grade Descriptors:

[As appropriate to the course and aligned with university standards]

Grades	**Short Description**	**Elaboration on subject grading description**
A	Excellent Performance	Students with excellent performance in the course

		demonstrate a strong grasp of lecture materials, critical thinking ability, and excel in various course assessments.
B	Good Performance	Students with good performance in the course demonstrate a solid grasp of lecture materials, critical thinking ability, and good performance in various course assessments.
C	Satisfactory Performance	Students with satisfactory performance demonstrate an adequate understanding of lecture materials, critical thinking ability, and satisfactory performance in various course assessments.
D	Marginal Pass	Students with a marginal pass show limited understanding of lecture materials, critical thinking ability, and minimal performance in various course assessments.
F	Fail	Students who fail the course display a lack of understanding of lecture materials, critical thinking ability and poor performance in the various course assessments

10. Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will include areas for improvement via canvas. Students who have further questions about the feedback including marks should consult the TA within one week after the assessment feedback is received.

11. Late submission Policy

Late submission will not be entertained; submissions later than the due time will not receive marks unless taken prior approval (only for medical or urgent scenarios) from the instructor/TA.

12. Course AI Policy

The use of generative AI tools (e.g., ChatGPT) is **allowed** for this course. However, students are required to verify the correctness and validity of any solutions, explanations, or content generated by AI. The instructor and TAs will not accept AI-generated content that is incorrect or demonstrates a lack of understanding.

13. Student Learning Resources - Lecture Notes, Readings

A. Lecture notes, Tutorial notes, supplementary materials
B. A. C. Phillips, The Physics of Stars, Wiley, paperback, 2/E. Additional resource: Mike Guidry, Stars and Stellar processes, Cambridge University Press 2019
C. Course homepage: https://canvas.ust.hk/courses/62594

14. Teaching and Learning Activities

Scheduled Activities: approximately 3 hr 30 mins [2 × 80 minutes (lectures) + 1 × 50 mins (tutorial)] / week

a. Lectures: focus on introducing concepts of stellar astrophysics and building an intuitive picture of physics inside stars.
b. Tutorials/Laboratory: focus on how to solve classwork problems.

15. Course Schedule

Basic Concepts in Astrophysics (6 lectures)	Basics of astronomy Stellar Spectra Gravitational Contraction Star formation The Sun Nucleosynthesis Stellar Life cycles Family of stars
Matter and Radiation (4 lectures)	Gases in Stars Electrons in Stars Photons in Stars
Heat Transfers in Stars (4 lectures)	Heat Transfer by Random Motion Heat Transfer by Convection
Thermonuclear Fusion in Stars (5 lectures)	Nuclear Fusion Hydrogen Burning

	Helium Burning Advanced Burning
Stellar Structure (3 lectures)	Simple Stellar Models Modeling the Sun Minimum and Maximum Stellar Masses
The Endpoints of Stellar Evolution (2 lectures)	White Dwarfs Stellar Collapse Neutron Stars Black Holes

16. 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.