San José State University
Department of Physics and Astronomy
ASTR 117B: Astrophysics II, Spring 2017

Course and Contact Information

Instructor:	Dr. Elisabeth Mills
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Office Hours:	Tuesday, Thursday 3:00-4:00 PM or by appointment
Class Days/Time:	Tuesday, Thursday 1:30 - 2:45 PM
Classroom:	SCI 319
Prerequisites:	PHYS 52 and MATH 31 with a C- or better.

Faculty Web Page and MYSJSU Messaging

Course materials such as the syllabus, in-class handouts, lecture notes, and homework assignments can be found on Canvas. You are responsible for regularly checking with the Canvas messaging system through MySJSU at http://my.sjsu.edu to learn of any updates.

Course Description

Physics of stellar structure and evolution; observed properties of stars; physics and chemistry of the interstellar medium; galaxies and cosmology. Prerequisite: PHYS 52 and MATH 31 with a C- or better. College of Science or Engineering Majors only.

This semester, the course will primarily focus on the physics and chemistry of the interstellar medium, star formation, and the physics of stellar structure and evolution. Students will apply their math and physics background toward solving a range of astrophysical problems that will prepare students for further study in this field. Over the course of the semester, students will also complete a project that connects the topics covered in this class to areas of current observational astronomical research, and will present the results of this project at the end of the class.

Course Goals

The goals of this course are (1) To apply prior physics background to construct an understanding of the fundamental processes by which stars are born, evolve, and die; (2) To be familiar with the indirect methods astronomers have used to develop theories of observationally inaccessible stellar interiors and stellar evolution over time scales many times larger than human existence; (3) To be equipped to solve a range of applied math and physics problems individually and in groups; (4) To build a transferable set of skills in researching, organizing, and presenting information.

Course Learning Outcomes (CLO)

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

1. Describe how the complex processes by which stars are born from interstellar gas, evolve through different forms, and ultimately end their lives can be understood using basic physics concepts.
2. List key methods that astronomers use in order to study distant objects that cannot be manipulated, to probe the hidden interiors of stars, and to determine how stars evolve, despite the extremely prolonged timescales on which this occurs.
3. Identify the equations and information needed to solve a range of astrophysics-related problems, and solve these problems either individually or in groups, and both with and without the aid of resources such as textbooks and the internet.
4. Conduct independent research using textbooks, online resources, and specialized astronomy tools to build a deeper understanding of a topic by organizing and prioritizing information from multiple sources, and presenting an interpretation of this information to an audience of peers.

Required Texts/Readings

Textbook

The primary textbooks for this class are
"An Introduction to the Theory of Stellar Structure and Evolution" by Diana Prialnik (any edition)
"The Physics of Stars" by A.C. Phillips (any edition)
"Astrophysics for Physicists" by Arnab Rai Choudhuri. A free eBook version **is** available from the SJSU library via the following address: http://discover.sjlibrary.org/iii/encore_sjsu/record/C__Rb4059685

Course readings for each topic will be suggested from a mix of all three of these textbooks, but I do not require that you have all of them.
I recommend having a copy of either Prialnik or Phillips as your primary resource for this course.
There will be a copy of Phillips on reserve at the MLK library.

Other Readings

Additional readings on some topics will be assigned from other online sources, including the 'Astrobites' website: https://astrobites.org/

Other technology requirements

The final project for this class will include presentations; access to the presentation software of your choice (for example, Powerpoint, keynote, or Open Office) will be needed for work on this project, some of which may be done outside of class hours. You will need to identify a personal or lab computer early on in the semester for this project.

Course Requirements and Assignments

This course will have 6 problem sets that will be assigned outside of class, 6 in-class (group work allowed) problem sets, 4 in-class (group work allowed) quizzes, 2 midterms, 1 final exam, and a project that will be conducted over the course of the semester culminating in a final presentation. All of these will contribute to the final grade and will allow multiple opportunities for feedback on student progress, and assessment of course learning goals.

There will also be additional problem-solving sessions held outside of normal office hours: a midterm exam study session, and a final exam study session.

Final Examination or Evaluation

A comprehensive written final examination will take place in the scheduled time for this section, on Tuesday May 23 beginning at 12:15 PM, lasting until 2:30 PM.

Grading Information

- Grades in this course will be a weighted average of scores from different components of the class:
  20% — 6 in-class group problem sets (graded on completion and effort)
  10% — 6 in-class project check-ins (graded on completion and effort)
  20% — 6 homework problem sets
  20% — 2 written midterm exams (1 in class and one take-home)
  10% — 4 in-class group quizzes (graded on completion and effort)
  10% — One final exam (graded on a 100 point scale)
  10% — One final project presentation (graded on a 100 point scale).
- Late homework will be accepted, but may be subject to a penalty of 10% for each day after the deadline
- Final grades will be assigned according to the chart below

A+ : 97-100%
A : 93-96%
A- : 90-92%
B+ : 87-89%
B : 83-86%
B- : 80-82%
C+ : 77-79%
C : 73-76%
C- : 70-72%
D+ : 67-69%
D : 63-66%
D- : 60-62%
F : Below 60 %

Classroom Protocol

I invite students to use the space in the classroom as you need to: sit, stand, walk and move around, or put your feet up. As this is a 75 minute class, please feel free to take any breaks you need. I trust that you recognize that you are ultimately responsible for your learning outcome from this class, and that you are doing what you need to in order to focus best. I ask that students participate as you are able in class discussions, and bring your computers in order to participate in-class activities.

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/"

ASTR 117B Spring 2017 Course Schedule

This schedule is subject to change with fair notice (one week in advance of any changes). Any changes will be announced in class and through Canvas.

Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1	1/26	Big bang and stellar nucleosynthesis; origin of chemical abundances *Reading: PH: 1.1, 1.5, 1.6, PR: 4.6-4.10*
2	1/31	Phases and properties of the ISM *Reading: CH: 6.5, 6.6*
2	2/2	Radiative transfer *Reading: CH: 2.2, PR: Appendix 1* **Problem set #1 due**
3	2/7	Thermodynamic equilibrium, heating, and cooling *Reading: CH: 2.3* **In-class Quiz #1**
3	2/9	Spectral lines, transitions, molecules, and astrochemistry *Reading:*
4	2/14	Gravitational collapse and contraction *Reading: PH 1.2* **Problem set #2 due**

Week	Date	Topics, Readings, Assignments, Deadlines
4	2/16	Introduction to the Virial Theorem *Reading: PH 1.3*
5	2/21	Protostars, Pre-main sequence evolution, and timescales *Reading: PH 1.7, PR 8.1*
5	2/23	**Midterm #1** **In-class**
6	2/28	Stellar structure equations: Local thermal equilibrium, conservation of energy *Reading: CH 3.2, PR 2*
6	3/2	Stellar structure equations: Hydrostatic equilibrium and equation of motion *Reading: CH 3.2, PR 2* **Problem set #3 due**
7	3/7	Stellar structure equations: Revisiting the Virial Theorem and stellar timescales *Reading: CH 3.2, PR 2*
7	3/9	Physics of gas and radiation: Equation of state, pressure *Reading: PH 2, PR 3* **In-class Quiz #2**
8	3/14	Physics of gas and radiation: Internal energy, adiabatic processes *Reading: PH 2, PR 3*
8	3/16	Physics of gas and radiation: Saha equation *Reading: PH 2, PR 3* **Problem set #4 due**
9	3/21	Heat transfer and energy transport: Radiative transfer in stars *Reading:*
9	3/23	Heat transfer and energy transport: Convection *Reading:* **In-class Quiz #3**
		Spring Break **No class**
10	4/4	Nuclear processes: Nuclear reaction rates *Reading: PR: 4.1, 4.2; PH: 4*
10	4/6	Nuclear processes: The p-p chain, CNO cycle, and triple-alpha process *Reading: PR: 4.3, 4.4, 4.5* **Problem set #5 due**

Week	Date	Topics, Readings, Assignments, Deadlines
11	4/11	Simple stellar models *Reading: PR:5, PH: 5*
11	4/13	Stellar scaling relations *Reading: CH: 3.4, PR: 5, PH:5* **Take-Home Midterm #2 Assigned**
12	4/18	The evolution of stars *Reading: PR: 7* **Take-Home Midterm #2 Due**
12	4/20	The main sequence and evolution of low-mass stars *Reading: PR: 8*
13	4/25	The evolution of high-mass stars *Reading: PR: 8*
13	4/27	Stellar Instability *Reading: PR: 6* **Problem set #6 due**
14	5/2	Supernovae and nucleosynthesis *Reading: 9* **In-class Quiz #4**
14	5/4	Brown dwarfs, degeneracy and the mass-radius relation *Reading: PR: 10.3*
15	5/9	White dwarfs *Reading: PH: 6*
15	5/11	Neutron stars and black holes *Reading: PH: 6, PR: 9.4, 9.5*
16	5/16	**Final project presentations**
Final Exam	5/23	**12:15 PM - 2:30 PM SCI 319**