ASTRONOMY 9609A: Stellar Structure & Evolution
2012-2013: Fall term

1 Instructor & Contact Information

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2 Course Description

This course offers an introduction to the physical principles and numerical methods involved in studying the structure of stars, and in understanding how that stellar structure changes over time. Much of the course is theoretical in nature, addressing the detailed processes of importance (e.g. nuclear processes, gravitational contraction, convective and radiative energy transport, ionization, ...) and how they affect the stellar structure, stability, dynamics and evolution. The numerical techniques and procedures required for solving the relevant equations of stellar structure will be covered. A few simple stellar models (e.g. polytropes) will be studied in detail and compared to more realistic numerical models. All this will then be combined to gain a fundamental understanding and description of how stars of different masses form and evolve, and result in various compact stellar remnants.

Prerequisite: this course is accessible to astronomy graduate students who have passed the Astronomy 9610 course (Introduction to Modern Astrophysics) or have passed the written part of the astronomy comprehensive exam. All other students require special permission.

3 Time and location

Lectures:	Monday & Thursday, 11.00am-12.30pm; Rm 22 PAB
Course website:	http://owl.uwo.ca/

Any changes to regular lecture times, dates or locations will be announced in class and through e-mail.

The course website will be the only medium where course materials are distributed, where announcements are made, where you can access your marks for various components of this course. It is your responsibility to check the course website frequently.

4 Course Materials

I will follow large parts of the textbook *"Stellar Structure and Evolution"* by Kippenhahn & Weigert. This textbook is great for the insight into the fundamental physics it offers. However, it is somewhat outdated (published in 1989), and a new, revised version is currently in press. It may thus not be worth buying the old book. Unfortunately, the new version will only be available by the end of November. There are two copies on reserve in the Taylor library; we can discuss other options in class.

Good additional references are "*Stellar Interiors*" by Hansen, Kawaler & Trimble, and "*Principles of Stellar Evolution and Nucleosynthesis* by Clayton.

5 Evaluation

Your final grade in this course will be derived according to:

- Problem Sets (homework assignments): 50%
- Midterm Exam: 25%
- Final exam: 25%

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

The pass standard for this course is at least a 60% overall and at least 50% on the weighted average of both tests.

Homework assignment grades and midterm exam scores will be posted on the class OWL site within a week. Any errors, or appeals to your scores, must be reported to your instructor within **two weeks** of their initial posting.

6 Problem Sets

Throughout the term, a total of six home work assignments (problem sets) will be distributed (see dates below). Each of these problem sets is worth 10% of your final mark, with the understanding that only the best 5 will be used toward your final grade.

The homework assignments are meant to *solidify* your understanding of certain aspects of the course material; you will thus need to first study and understand the relevant parts of course the material. You are encouraged to discuss your approach to these problem sets with your classmates, and I will even set apart time in class to address the assignments and discuss any problems you may have. If you can't figure something out, or if it's taking an inordinate amount of time, please come and see me to discuss these difficulties in person. You should however work out and write up the solutions yourself and your submission should represent your own original work.

Some of the problem sets involve writing computer programs. You can use any computer language you are most comfortable with (IDL, MatLab,). Unless explicitly asked for, you do not need to include your code in your submission. As indicated in the list below, problem sets will be distributed or announced in class, and will be due at the beginning of the lecture indicated below. I tend to be strict about this – please don't be late with assignments, and hand your work in to me in person; otherwise you may get a penalty.

- Problem Set #1: Distributed Thu, Sep 13; due Mon, Sep 24.
- Problem Set #2: Distributed Thu, Sep 27; due Mon, Oct 8.
- Problem Set #3: Distributed Thu, Oct 11; due Mon, Oct 22.
- Problem Set #4: Distributed Thu, Nov 1; due Mon Nov 12.
- Problem Set #5: Distributed Thu, Nov 15; due Mon Nov 26.
- Problem Set #6: Distributed Mon, Nov 26; due Thu Dec 6.

Remember that clarity is essential for getting partial or full credit for problems. Make sure you show all steps leading to your final answer. Answer the questions in the order assigned. Finally, remember to include the appropriate units for any numerical answer and take care of the significant digits.

7 Exams

There are two, non-cumulative tests for this course, each worth 25% of your final mark. The midterm exam will be on Thu, Nov 1st, 2012; 11:00am-12:30am in the regular lecture room. There will be no lecture on that date. This test covers the material discussed in class up to and including the lecture on Oct 25th. The final exam will be in December (precise date and time TBD) and will cover the remainder of the material. Note that a weighted average of at least 50% over both tests is required to pass the course.

Travel: Students needing to make travel arrangements are advised to book a travel date after the end of the examination period. No makeup exams will be given to accommodate travel!

8 Course Calendar

- Assignment due dates are Sept. 24; Oct 8; Oct 22; Nov. 12; Nov. 26; Dec. 6
- Midterm Exam: Thu, Nov 1st.
- Final exam: during the December exam period. Details to be announced.

9 Make-up Policy

If you miss an assignment or an exam due to illness or a serious circumstance, notify me and come and talk to me as soon as possible.

10 Accessibility

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 Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

11 Scholastic Offenses

It is an academic offense to cheat on a test or exam, to plagiarize a course project or problem set, or to modify marked material to falsely justify additional credit. Scholastic offenses are discussed in detail (see http://grad.uwo.ca/current_students/graduate_regulations/section_10.htm) in Section 10 of your Graduate Calendar; you should read that section carefully. Any student caught in this behavior will receive a mark of zero on the course component in question and may be subject to further penalty.

12 Advice for successful performance

The best way to get the most out of this course and do well on tests and exams is to spend enough time on the course material *on a regular basis*. You should probably expect to spend at least 10 hours per week on the course, in addition to attending lectures. Prepare for class by first reading and then studying the

chapters that will be covered in class. Write down what you have difficulties with, and ask questions in class. Make sure you really understand the course material, and do so before starting the assignments!

For the assignments, take enough time to try to understand the question: what is really being asked of you? In case of doubt for assignments, ask your colleagues and/or the instructor. When appropriate, try to outline a strategy first, and try to work towards a solution yourself before asking your colleagues – in the end, you're on your own for exams, so you'd better have some ideas about how to solve these problems when there's nobody around to ask! Do not spend inordinate amounts of time on these assignments though – use good judgment and talk to the instructor in case of difficulties! Also, please do not "invent" new mathematics to make your answers work out....

For Exams, you should similarly take enough time to understand the question, and strategize. When getting an answer, try to use critical sense: is your answer about what you expected? Does it make sense to you? If you think your answer is wrong, but you don't see where you went wrong, write down why you think the answer is wrong.

Version History

v1.0	Sep 5, 2012	First version.
v1.1	Sep 5, 2012	Fixed minor typo in course description.