Astronomy 3415: Astrophysics
Syllabus — Spring 2003

Course ID:	ASTR-3415-001 (3 credit hours)
Lecture Times:	T R 11:15 p.m. – 12:35 p.m.
Lecture Location:	Brown Hall, Room 264
Lecturer:	Dr. Donald Luttermoser
E-mail:	lutter@mail.etsu.edu
Office Hours:	M W 2:10 p.m. – 3:00 p.m. (279 Brown Hall, 423-439-7064)
Textbook:	*An Introduction to Modern Astrophysics* (1996) by Carroll & Ostlie, Addison-Wesley Publishing Company, ISBN 0-201-54730-9

Course Outline

Week	Topics	Readings
January 9	Radiative Transfer & Atomic Structure	Chapters 3, 5
January 14, 16	Stellar Spectra & HR Diagram	Chapter 8
January 21, 23	The Solar and Stellar Atmospheres	Chapters 11, 9
January 28, 30	Stellar Interiors	Chapters 10, 11
February 4, 6	**Exam 1 on 2/4** & Stellar Birth	Chapter 12
February 11, 13	Stellar Midlife and Old Age	Chapters 13, 14
February 18, 20	Stellar Death & Black Holes	Chapters 15, 16, 17
February 25, 27	Star Clusters & Stellar Dynamics	Chapters 2, 22
March 4, 6	The Interstellar Medium	Chapters 12, 22
March 11, 13	The Milky Way Galaxy	Chapter 22
March 18, 20	**Spring Break**	
March 25, 27	**Exam 2 on 3/25** & Normal Galaxies	Chapter 23
April 1, 3	Active Galaxies & Supermassive Black Holes	Chapters 14, 26
April 8, 10	Galaxy Clusters & Hubble's Law	Chapter 25
April 15, 17	Gravitation, General Relativity, & Cosmology	Chapter 27
April 22, 24	The Big Bang and the History of the Universe	Chapter 28
April 29	**Exam 3 due by 5 p.m. on this day**	

Please consult the University's supplemental syllabus at http://www.etsu.edu/reg/syllabus.htm for additional information.

The courses notes are available to you on the web at the home page for the course at http://www.etsu.edu/physics/lutter/courses/astr3415/index.htm in both postscript (PS) and PDF format.

Overview

Astrophysics covers the theoretical basis of what we know about the Universe. It is the study of astronomical phenomena through the techniques described by physics: mechanics, atomic and molecular physics (*i.e.*, quantum mechanics), nuclear physics, relativity, and electromagnetism, to name only a few. The students will have a firm understanding of the basics of astrophysics at the conclusion of this course. Students should have already taken (or concurrently taking) PHYS-2110/20, *Technical Physics I & II* before taking this course. Mathematics through *Calculus III* also would be useful. Topics will include stellar atmospheres, stellar interiors, stellar evolution, galactic structure, galaxies, and cosmology. The main goal of this course is to demonstrate how the Universe works. Astrophysics is a problem-solving course, that is, the measure of a student's progress is demonstrated by the ability to solve numerical problems in astrophysics, and not just to quote laws and formulas. The class notes will be extremely useful as a guide for solving problems on the exams and homework, so it is strongly recommended that you attend each lecture. The homework will be designed to help develop these skills and the exams to test the student on these skills. It is assumed that the students all have a reasonable working knowledge of calculus and trigonometry at the *Technical Physics* level. Basic differential equations will be introduced to the student along with the methods used for solving them when these equations are encountered. There also will be a **course project** that will be due by the end of the semester. This project will involve computer modeling in the Computer Lab of Brown Hall 264. Comparisons will then be made between the model and astronomical observations in the analysis component of the project.

Exams, Homework, & Computer Project

There will be 3 exams throughout the semester on the dates listed on the syllabus — **there will not be a comprehensive final**. Each exam will cover material prior to the test and be taken during class time (except for Exam 3). Each exam will be worth 100 points. There will be 4 or 5 problem sets (*i.e.*, homework) assigned throughout the semester. Each set will contain anywhere from 4 to 10 problems which the student will have to turn in approximately 2 weeks after they are assigned. The homework is worth 30% of your final grade, so don't ignore doing it. They will also prove to be very useful in preparing for the exams. Some of the problems on the homework will involve use of a computer. Finally, there will be a course project which will involve the analysis of synthetic spectra generated from the ATLAS stellar atmospheres code. Both ATLAS and IDL procedures to analyze the spectra will be available on the computers in Brown Hall 264. You will be given handouts near the beginning of the semester that will give brief tutorials on Fortran and IDL to help you understand what the codes are doing. As well, a separate handout will be passed out that describes this computer project in detail. An 8-10 page term paper describing your work is required for this project. This paper will be due by **Tuesday, April 10th**. For those of you familiar with LaTeX, I will have a LaTeX template file available of the machines in Brown Hall 264 that you can use for your term paper.

Grading

The grading system will be based by the following criteria:

$$\textbf{Final Grade} = [0.15 * (\frac{\text{Exam 1}}{100}) + 0.15 * (\frac{\text{Exam 2}}{100}) + 0.15 * (\frac{\text{Exam 3}}{100}) + 0.25 * (\frac{\text{Project}}{100}) + 0.30 * (\frac{\text{Homework}}{400})] * 100\%$$

The final grades will be based on the following scale:

A	=	90% or better	**B-**	=	73–75.9%	**D+**	=	56–58.9%
A-	=	88–89.9%	**C+**	=	70–72.9%	**D**	=	50–55.9%
B+	=	86–87.9%	**C**	=	62–69.9%	**F**	=	Less than 50%
B	=	76–85.9%	**C-**	=	59–61.9%			

Note that a failing grade also will be given if the student has engaged in any form of academic dishonesty including (but not limited to) copying and plagiarism.