

PHYSICS 5010/ASTRONOMY 5010: Astrophysics and Stellar Astronomy

COURSE OUTLINE: FALL 2017

LECTURER: Professor J. M. Wadehra

OFFICE: Room 264, Physics Research Building **PHONE:** 313 577 2740 **EMAIL:** Wadehra@wayne.edu

OFFICE HOURS: Mondays and Tuesdays from 11:00 AM to 12:00 Noon or by appointment or, simply, drop by.

TEXT: An Introduction to the Theory of Stellar Structure by Dina Prialnik (Cambridge 2011)

COURSE PREREQS: AST 2010, PHY 3300/3310

MEETING PLACE: Tuesdays and Thursdays from 1:00 PM to 2:15 PM in Room 177, Physics Research Building

1. EXTRA READING.

The assigned text covers all the material for this course. A few reference books that cover similar materials at roughly the same level are:

An Introduction to Modern Astrophysics by B.W. Carroll and D. A. Ostlie (Pearson 2007)

Stellar Structure and Evolution by J. Christensen-Dalsgaard (Available free online)

Stellar Structure and Evolution by O.R. Pols (Available free online)

You may wish to refer to these books for additional reading about topics that interest you.

2. HOMEWORK ASSIGNMENTS.

A few problems from the text and from other sources will be assigned almost every week. You are expected to work out these assignments *independently* and turn in the solutions for grading by due date. Late homework assignments will not be accepted.

3. EXAMS AND GRADING.

Your grade in the course will be determined, as follows, by your performance in three exams, your attendance in class and your performance in solutions of assigned homework problems:

First Hourly Examination	100 points	A: 450-500 pts; A-: 425-449 pts;
Second Hourly Examination	100 points	B+: 400-424 pts; B: 375-399 pts;
Final Examination	150 points	B-: 350-374 pts; C+: 325-349 pts;
In-class Attendance	52 points	C: 300-324 pts; C-: 275-299 pts;
Homework	98 points	D+: 250-274 pts; D: 225-249 pts;
TOTAL	500 points.	D-: 200-224 pts; F: 0-199 pts.

Tentative dates for hourly exams are Thursday, October 5 and Tuesday, November 7; these exams will be held in the classroom. Results of the hourly exams as well as the graded homework problems will be handed back in the class. The final exam will be on Thursday, December 14 from 12:30 PM to 2:30 PM in room 177 of Physics Research Building. The final exam will cover all the material of this course; however, there will be slight emphasis on material not covered by the first and the second hourly exams. **THERE WILL BE NO MAKE-UP EXAMS OR HOMEWORK.**

4. TOPICS TO BE COVERED.

Day	Date	Lecture Topics	Chapter	HW due
Th	8/31	Review of Modern Physics		
Tu	9/5	Review of Modern Physics		
Th	9/7	Review of Modern Physics		
Tu	9/12	Introduction, Stellar Basics	1.1-1.3	HW 1 Due
Th	9/14	HR Diagram, Equilibrium, Dynamics	1.4, 2.1 – 2.4	
Tu	9/19	Evolution, Timescales	2.5 – 2.8	
Th	9/21	Equation of State, Pressure	3.1 – 3.4	HW 2 Due
Tu	9/26	Radiation, Radiative Transfer	3.5 – 3.7	
Th	9/28	Nuclear Reactions, Hydrogen Burning	4.1 – 4.4	
Tu	10/3	He, C, O, Si Burning, Heavy Elements	4.5 – 4.10	HW 3 Due
Th	10/5	Exam 1 (Chapters 1 – 4)		
Tu	10/10	Elliptical Orbits, Newtonian Mechanics	CO 2.1-2.2	
Th	10/12	Kepler's Laws, Virial Theorem	CO 2.3-2.4	
Tu	10/17	Simple Stellar Models I	5.1 – 5.4	HW 4 Due
Th	10/19	Simple Stellar Models II	5.5 – 5.7	
Tu	10/24	Thermal Stability, Dynamic Stability	6.1 – 6.4	
Th	10/26	Convection	6.5 – 6.7	HW 5 Due
Tu	10/31	T- ρ evolution. The Main Sequence.	7.1 – 7.4	
Th	11/2	Late evolution	7.5 – 7.6	
Tu	11/7	Exam 2 (Chapter 5 – 7)		
Th	11/9	Pre-main Sequence, Main-sequence Phase	9.1 – 9.3	HW 6 Due
Tu	11/14	Red Giant Phase	9.4 – 9.6	
Th	11/16	Star Death and Massive Stars	9.7 – 9.10	
Tu	11/21	Supernovae	10.1 – 10.3	HW 7 Due
Th	11/23	Thanksgiving – no class		
Tu	11/28	Neutron stars and Black Holes	10.4 – 10.6	
Th	11/30	Binary Stars	11	
Tu	12/5	Stellar Life Cycle	12	
Th	12/7	Catch up		
Tu	12/12	Study day – no class		
Th	12/14	Final Exam (12:30 – 2:30 pm)		

5. LEARNING OBJECTIVES/OUTCOMES.

At the successful completion of this course, you will be able to understand the birth, life and death of a typical star. You will have an appreciation of the roles that laws of physics play in determining the structure and evolution of stars.