

PHYS 444 SYLLABUS

INSTRUCTOR: Vayujeet Gokhale
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WHERE/WHEN WE MEET: Class: 14:30 PM – 15:20 PM (MWF): Room MG I099

OFFICE HOURS (ONLINE):
Monday, Tuesday, Wednesday, Thursday: 10:30 AM – 11:20 AM

TEXTBOOK:

- **An Introduction to Modern Astrophysics [BOB] : Carroll & Ostlie**

Other Texts:

1. Free Online textbook by O. Pols: http://astro.ru.nl/~onnop/education/stev_utrecht_notes/
2. Free Online textbook by E. Brown: <https://web.pa.msu.edu/people/ebrown/docs/stellar-notes.pdf>
3. Free OpenStax textbook 'Astronomy' by Fraknoi, Morrison & Wolff:
<https://openstax.org/details/books/astronomy>

Additional free resources will be posted on Blackboard

Course Delivery Requirements: Computer/tablet, computer audio, internet access (preferably high-speed) ability to scan or photograph homework, quizzes etc.

All course information is managed on Blackboard (<http://blackboard.truman.edu/>).

Course Content

Course Outline:

In this advanced astrophysics class, we will study stellar structure and the evolution of single and binary stars. We will focus on the theoretical concepts and methods used by astronomers and astrophysicists to study the surface properties of stars as well as the study of stellar interiors. Stellar astrophysics is an excellent example of the interplay of some of the most fundamental laws of microscopic and macroscopic physics. You will have the opportunity to draw on your knowledge of classical & quantum physics, thermodynamics & statistical physics, electromagnetism, particle and nuclear physics, and fluid dynamics. An outline of the weekly schedule of this course is on the last page of this syllabus.

To give you an idea of how this course fits into the general scheme of things, we quote the following description of the course (Phys 331) from the general catalogue –

“Stellar Astrophysics will cover the physics of stellar formation, structure and evolution. We will study our nearest star, the Sun, and other low mass stars, as well as high mass stars. We will study stellar nucleosynthesis, which involves nuclear, quantum & particle physics, statistical physics, fluid dynamics, electromagnetism, and relativity. The purpose of this course is to give the students a thorough exposure to the current status of our observational and theoretical understanding of stars.”

Course Objectives

At the end of this course students should be able to understand and explain:

1. the basics of stellar structure, evolution, and stellar nucleosynthesis,
2. the fate of low and high mass stars (white dwarfs, neutron stars, black holes),
3. the different types of binary stars and their evolutionary fates,
4. the formation and evolution of stellar populations (clusters and galaxies),
Additionally, students should be able to
5. use (and modify) computer codes simulating stellar evolution and evolution of stellar populations.

Credit Hour Justification:

The minimum investment of time by the average Truman student necessary to achieve the learning goals in this course are not less than one hour (50 minutes) of classroom instruction and a minimum of two hours of out of class student work each week per credit hour awarded or at least the equivalent of three hours (2:50) of laboratory work, internships, practica, and other academic work each week per credit hour awarded. This average time per week for an average student may have weekly variations.

Course Delivery

Due to the uncertain situation related to the COVID-19 pandemic, the course will be offered in an “hybrid” format (i.e. less than 75% of course content will be delivered online). Zoom links, if required, and other logistics regarding class meetings will be discussed during the first lecture, and appropriate links and information will be posted on the course Blackboard page.

FACE COVERING REQUIREMENTS: Consistent with guidance for higher education institutions from the Centers for Disease Control and to help us reduce the possible spread of COVID-19, when this class meets, or you attend office hours, you will be required to wear a face covering that completely covers your nose and mouth. You will be expected to keep the covering on at all times while we are meeting. In the event you arrive to class without a face covering, I will ask you to leave until you are able to obtain one and return. Thank you for your help in containing this virus and helping to protect your peers.

Course Workload: This course is worth THREE credit hours. In addition to the scheduled class meeting times, which are the equivalent of 150 minutes per week, you should expect to do an average of 300 minutes of work per week related to this course outside of class. This may include, but is not limited to, reading, written assignments, essays, discussion boards, study for examinations and quizzes, and other tasks as described in this syllabus. The time to complete these tasks is an average that represents the typical amount of time a student can expect to commit. Times may vary by the student.

Disability Services: To obtain disability-related academic accommodations students with documented disabilities must contact the course instructor and the Office of Student Access and Disability Services (OSA) as soon as possible. Truman complies with ADA requirements. For additional information, refer to the Office of Student Access and Disability Services website at <http://disabilityservices.truman.edu/>. You may also contact OSA by phone at (660) 785-4478 or email studentaccess@truman.edu

Attendance, Exams & Quizzes:

There will be **two tests and one final exam** in total through the course. Two of the three tests will cover only partial material, for example, material covered since the previous test. **The final exam will be comprehensive;** I will let you know in due course what you are expected to know. Quizzes will contribute substantially toward your final grade, and will be assigned quasi-regularly throughout the semester. I will take **attendance** at random several times through the semester. If you know beforehand that you are going to miss a particular class for official reasons (sick, going for a conference or athletic meet etc), it is your responsibility to notify me ahead of time (via email is fine). The point distribution is outlined below –

	<i>Number</i>	<i>Points Per</i>	<i>% Total</i>
Homework	5	25	25
Quizzes	10	15	15
Mid term	1	100	15
Project + Paper	1	100	20
Final	1	100	25

All quizzes, homework and tests **must** be done individually, unless otherwise specified by the instructor.

With regard to attendance, the General Catalog states:

“The university expects students to attend all classes, yet recognizes co-curricular opportunities could lead to class absences. Faculty, students, and staff have the responsibility to support an environment that upholds the integrity of a Truman education and students’ ability to experience a diversity of educational experiences. Truman adheres to Federal law regarding accommodations. Absences related to disability accommodations will be handled in coordination with

the Disability Services Office. Absences related to Title IX will be handled in coordination with the Institutional Compliance Office.”

No student having a sanctioned absence shall be penalized for such absence on account solely of being absent. Nothing in this policy is intended to excuse a student from the responsibility to make up missed work within a reasonable length of time. Nevertheless, students are strongly encouraged to attend required in-person or synchronous online class meetings when they can (i.e., they show no signs of illness and have no other sanctioned reason to be absent).

Response Time and Feedback

Generally, on weekdays I will respond within a few hours (or less) to emails. After hours (after about 5:00 PM), depending on my schedule I will try and respond at night, or early next morning.

Substantive Interaction

Truman policy and federal regulations require that students demonstrate that they are academically engaged in the courses they take. You must meet this requirement within the first calendar week of the semester, beginning at 12:00 am on Monday (10th January 2022) and ending 11:59 pm Saturday (15th January 2022). Failure to do so, or to provide an explanation of an extenuating circumstance by that date and time will result in your removal from the course. Under certain circumstances, removal could impact your scholarship eligibility or financial aid. For the purposes of this class, establishing academic engagement requires, at a minimum, attendance in the classes scheduled in the first week and submission of the first assignment.

SPECIAL STATEMENT ON ATTENDANCE DUE TO COVID-19

Your health and safety, and that of your classmates is of primary importance. I will work with you to the extent possible, and bit beyond if needed, to make sure you have enough time to catch up, in case you miss class due to a COVID-related cause. I do not want you to feel pressured to come to class, or work on an assignment if you are not feeling well (physically, emotionally, or are mentally exhausted or distracted). Please feel free to contact me as soon as you are comfortable doing so – the earlier the better, if you find yourself falling behind or overwhelmed. I want this class to be an enjoyable learning experience, and yes, there will be homework and quizzes and tests and due dates. But...

Your well-being comes first – everything else, we can make up in time

Test/Exam Schedule (Tentative, Subject to change)

Test	Date	Topics	Book Chapters (BOB)
Mid-term	Mid-October	<i>Spectral Classification, Interiors of stars, The Sun, Main Sequence</i>	<i>3, 5, 8, 10, 11, 13</i>
Final	Finals week	<i>Above + Stellar Pulsation, Fate of Massive stars, WDs, Neutron Stars, Binary Stars</i>	<i>13, 15, 16; 7, 18</i>

Grading, Final Grades etc.

The grade scheme is already outlined in the table above. I reserve the right to modify some aspects of it, depending on progress made as we go along, but the weight that each field carries will remain the same (quizzes will still count for 10% of your grade etc). The grading scheme is as follows:

% Range	Letter Grade
90-100	A
80-90	B
70-80	C
60-70	D
0-60	F

If you have any questions about the point and grading scheme, please ask me right away. With respect to the letter grade, I reserve the right to upgrade borderline cases to a higher grade. I will never downgrade anyone. You will have an opportunity to obtain extra-credit, for example, on lab reports or ‘outreach work’ done exceptionally well, and so on. **Assigning extra credit is left largely to my discretion.**

Academic Integrity: Academic dishonesty of any form will not be tolerated in this class. Anyone caught cheating on a test, quiz or lab will automatically receive a grade of zero on that test, quiz or lab. Further disciplinary action consistent with University policy will be considered, including failing the course. Students are encouraged to discuss coursework as well as lab and take-home quiz assignments with their fellow students, but are required to complete all of their coursework and assignments using their original words and ideas and should properly cite the words and ideas of others. Students are expected to work alone on the exams and quizzes without the use of any outside resources (other than those permitted by your instructor). Students are also expected to be honest in their interactions with the professor. A student found to have not upheld these expectations is subject to failing this course and being reported to the appropriate authorities. For more information about the University policy on academic dishonesty, consult the appropriate sections of the Student Conduct Code (see the code and related information at <http://conduct.truman.edu>).

Statement on disruptive behavior

"Behavior that persistently or flagrantly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. Such behavior inhibits other students' ability to learn and an instructor's ability to teach. A student responsible for disruptive behavior may be asked to leave class pending discussion and resolution of the problem..." and may be reported to the Office of Citizenship and Community Standards. (*Quotation from Washington State University*).

University Student Support Services

The University provides a range of both academic and student support services to ensure your success. These offices can advise you on learning strategies, point you toward valuable services, and help you troubleshoot technical problems as they arise.

Center for Academic Excellence

The Center for Academic Excellence provides advising services for students in their first year for most departments, as well as tutoring services. The Center is located in Kirk Building I12 and it may be reached at 660-785-7403.

Counseling Services

Counseling Services are available on campus at McKinney Center. Appointments may be scheduled by calling (660) 785-4014. An after-hours crisis line is also available at 660-665-5621.

IT Help Desk

The IT Service Center has combined the IT Call Center, Help Desk and Telephone Services into a one-stop location to serve you. You will find the following services and more when you stop by Pickler Library 109 or call 660-785-4544. You may submit a customer support ticket.

Office of Student Access and Disability Services

To obtain disability-related academic accommodations students with documented disabilities must contact the course instructor and the Office of Student Access and Disability Services (OSA) as soon as possible. Truman complies with ADA requirements. For additional information, refer to the Office of Student Access and Disability Services website at <http://disabilityservices.truman.edu/>. You may also contact OSA by phone at (660) 785-4478 or email studentaccess@truman.edu.

Writing Center

I encourage you to use the University's Writing Center for your writing projects. It is not a proofreading service. The writing consultants will read your work and give you feedback, letting you know what is working well (and why) and what might not be working so well (and why). They can help you understand and better your writing craft. They can also do brainstorming if you're having a hard time getting started. And they have an online scheduler, so making an appointment is easy. The Writing Center is located in Kirk Building I20. If you would like to receive participation credit for working with a writing consultant, please notify the Writing Center that you want them to email me a confirmation when making the appointment.

Quick Links to Other Student Services

Various offices that provide services to online students are identified at the [One Stop Services page](#) on online.truman.edu. You can also use this list of links to Truman [Administrative Offices](#) and [Academic Departments](#).

FERPA

Education records are protected by the Family Education Right to Privacy Act (FERPA). As a result, course grades, assignments, advising records, etc. cannot be released to third parties without your permission. There are, however, several exceptions about which you should be aware. For example, education records can be disclosed to employees or offices at Truman who have an “educational need to know”. These employees and offices may include your academic advisor, the Institutional Compliance Officer, the Registrar’s Office, or Student Affairs depending on the type of information. For more information about FERPA, see <http://www.truman.edu/registrar/ferpa/>.

Emergency Procedures

In each classroom on campus, there is a poster of emergency procedures explaining best practices in the event of an active shooter/hostile intruder, fire, severe weather, bomb threat, power outage, and medical emergency. This poster is also available as a PDF at this link: <http://police.truman.edu/files/2015/12/Emergency-Procedures.pdf>.

Students should be aware of the classroom environment and note the exits for the room and building. For more detailed information about emergency procedures, please consult the Emergency Guide for Academic Buildings: <http://police.truman.edu/emergency-procedures/academic-buildings/>

This six-minute video provides some basic information on how to react in the event there is an active shooter in your location: <http://police.truman.edu/emergency-procedures/active-shooter/active-shooter-preparedness-video/>

Truman students, faculty, and staff can sign up for the TruAlert emergency text messaging service via TruView. TruAlert sends a text message to all enrolled cell phones in the event of an emergency at the University. To register, sign in to TruView and click on the “Truman” tab. Click on the registration link in the lower right of the page under the “Update and View My Personal Information” channel on the “Emergency Text Messaging” or “Update Emergency Text Messaging Information” link. During a campus emergency, information will also be posted on the TruAlert website <http://trualert.truman.edu/>.

Discrimination and Title IX

Truman State University, in compliance with applicable laws and recognizing its deeper commitment to equity, diversity and inclusion which enhances accessibility and promotes excellence in all aspects of the Truman Experience, does not discriminate on the basis of age, color, disability, national origin, race, religion, retaliation, sex (including pregnancy), sexual orientation, or protected veteran status in its programs and activities, including employment, admissions, and educational programs and activities. Faculty and staff are considered “mandated reporters” and therefore are required to report potential violations of the University’s Anti-Discrimination Policies to the Institutional Compliance Officer.

Title IX prohibits sex harassment, sexual assault, intimate partner violence, stalking and retaliation. Truman State University encourages individuals who believe they may have been impacted by sexual or gender-based discrimination to consult with the Title IX Coordinator who is available to speak in depth about the resources and options. Faculty and staff are considered “mandated reporters” and therefore are required to report potential incidents of sexual misconduct that they become aware of to the Title IX Coordinator.

For more information on discrimination or Title IX, or to file a complaint contact:

Ryan Nely, Institutional Compliance Officer, Title IX and Section 504 Coordinator

Office of Institutional Compliance, Violette Hall, Room 1308, 100 E. Normal Ave, Kirksville, MO 63501

Phone: (660) 785-4354, titleix@truman.edu

The institution’s complaint procedure can be viewed at <http://titleix.truman.edu/files/2015/08/University-Complaint-Reporting-Resolution-Procedure.pdf> and the complaint form is accessible at <http://titleix.truman.edu/make-a-report/>

SCHEDULE (TENTATIVE)

Week	#	Topics	Chapters [BOB]	Most Important concepts
10 th Jan	1	Review	3, 5	EM Radiation, Wein's Law, SB Law; Bohr model
17 th Jan	2	Review	3, 5, 8	Spectra, Stars & EM Radiation; HR Diagram
24 th Jan	3	Review	5, 8	HR Diagram
31 st Jan	4	Stellar Structure	10	Hydrostatic Equilibrium, Energy Transport
7 th Feb	5	Stellar Structure	10	Hydrostatic Equilibrium, Energy Transport
14 th Feb	6	Stellar Structure	11	The Sun
21 st Feb	7	Stellar Nucleosynthesis	10, 13	Stellar Evolution
28 th Feb	8	Stellar Nucleosynthesis	MIDTERM	Stellar Evolution
7 th Mar	9	SPRING BREAK		
14 th Mar	10	Stellar Evolution	13, 15	PN+WD, Supernovae, Nucleosynthesis
21 st Mar	11	Stellar Evolution	15, 16	PN+WD, Supernovae, Nucleosynthesis
28 th Mar	12	Stellar Evolution Codes	13, 15, 16	Hurley Single Star Evolution Code
4 th Apr	13	Stellar Evolution Codes	13, 15, 16	Hurley Single Star Evolution Code
11 th Apr	14	Binary Stars	7	Classification of binary stars, properties of stars
18 th Apr	15	Close Binary Stars	7, 16	Binary Star Evolution, Type Ia Supernovae
25 th Apr	16	Review	PROJECT DUE	
2 nd May	17	FINAL		