Physics and Engineering Student Handbook

Truman State University

Fall 2023 – Spring 2024

20th edition. Revised by faculty in the Physics Department. The original student writers were Kathy R. Jenkins and J. Andrew Upchurch. Some portions taken from other Truman State University material.

This handbook represents the best of our knowledge at the time of the last revision, November 2023. While the physics faculty have carefully looked over this information, we cannot absolutely guarantee its accuracy. The Truman General/Graduate Catalog is your official source of information.

Contents

Chapter 1

Introduction

This is a reference guide for physics and pre-engineering studies at Truman State University. It is intended to help first years learn the ins and outs of the department. Upperclass students might use this handbook when planning for future semesters.

Chapter 2 has information applicable to both physics and pre-engineering majors, on such things as advisors, physics tutorial services, the Society of Physics Students and assessment at Truman. Also in this section is advice from alumni of the physics program—helpful hints and suggestions on how to make the most of your time here.

Chapter 3 is specifically for physics majors and minors. It describes the physics department, general honors, and double-majoring. It also gives information on how to ensure you will be prepared for graduation and ready for the next step: graduate school or a job.

Chapter 4 is dedicated to pre-engineering and the Dual Degree program. It includes the process of transferring to an engineering school when your Truman coursework is complete.

In Chapter 5 lists the physics faculty: names, locations, email addresses, and phone numbers. It's a very good idea to seek out and get to know the faculty! They are always available during their posted office hours, and are usually available at other times as well.

Finally, there are a number of helpful physics curriculum summary documents in Chapter 6.

We suggest that you refer to this handbook often during your stay at Truman, but we also remind you that the best source for complete, correct and updated information is your academic advisor.

The Physics Faculty

Chapter 2

General Information

2.1 Sources of Help

Academic Advisors

Each student is initially assigned an academic advisor in their residential college. Advisor assignments are announced at the beginning of your first year. You should meet with your advisor frequently to talk about your progress and to develop your courses of study.

After your first year, you will be assigned an official faculty advisor. Although it is a good idea to keep one physics advisor throughout your academic career, after your first year, you may change your advisor at any time.

Registration for classes is done online each semester by individual students. However, you need your academic advisor's approval to register for classes and to make changes in your class schedule. Set up an appointment well before your registration time, and come to the meeting well prepared. Consult your advisor often, ask questions even if they seem of little importance, and be sure to also tell your advisor when everything is going fine!

Tutorial Services

- *The Society of Physics Students* (SPS) offers free tutoring for introductory physics courses, in MG 1098 every Sunday through Thursday, usually 7 to 9 pm. For information contact edis@truman.edu.
- Math tutoring is often set up for each class by the instructor.
- Another resource for tutoring is The Tutoring Center, located with The Center for Academic Excellence (excellence.truman.edu).

2.2 Student Organizations

The Society of Physics Students

The *The Society of Physics Students* (SPS; sps.truman.edu) is a social organization for everyone with an interest in physics—physics majors, pre-engineers, math majors, and others. SPS is the driving force behind the activities that bring the students and faculty together. These activities include picnics, dinners, trips, and meetings. SPS helps to create a sense of community within the department and promotes friendship among the students and faculty.

Currently, SPS meets over pizza once every two weeks, in a room in Magruder Hall that changes from semester to semester. For dues of $5 a semester, all that pizza is a good deal. Email edis@truman.edu to get the latest information.

Aside from social activities, SPS coordinates a tutoring program. Every evening, Sunday through Thursday, one or two physics majors who have already had their introductory courses are available for a few hours to help. Then there is the SPS Demo Team which takes fun physics demonstrations to local elementary and high schools to stimulate excitement about science in young people. On occasion, SPS will take a trip to a national laboratory or a university to observe cutting-edge research, and periodically they host a Zone Meeting for several SPS chapters from other universities in our region of the country.

Ask how you can obtain an SPS-designed Truman physics T-shirt.

Sigma Pi Sigma

Sigma Pi Sigma is the physics honor society. Students who have completed both semesters of calculus-based general physics (Phys 185, 186, 190, and 191), who have donated at least one semester of physics-related service (such as physics tutoring or physics outreach), and who remain in the top third of their class by overall GPA are invited into membership. Membership in ΣΠΣ is lifelong.

Stargazers Astronomy Club

The *Stargazers Astronomy Club* (stargazers.truman.edu) is open to all students interested in astronomy. Members perform observations with telescopes, and participate in long-term observing projects, field trips, and other activities. No prior experience is required.

The Truman State University Observatory (observatory.truman.edu) is located at the the University Farm, about one mile west of campus. The Observatory is home to all astronomy-related activities in the Physics department, including astronomy research projects, astronomy class labs, public open house events, and casual stargazing. Facilities include a computer controlled 14-inch Schmidt-Cassegrain telescope housed in a five-meter rotating dome, several other refracting and reflecting telescopes, and two CCD cameras for imaging. Students with appropriate training may use the Observatory facilities for research or for casual observing.

Women In Physics

Women in Physics (wip.truman.edu) supports female physics and engineering majors and minors, but is open to all students. Their activities include meetings every other week and social functions such as designing WIP T-shirts, sports events with other clubs, bonfires, and movie nights. WIP actively promotes the idea that physics is not just for guys, and they communicate this to new students at majors day and potential students at visit days. Community service includes the Big Event and physics demonstrations for kids in elementary school at the Adair County Public Library at least once each semester. Members have the opportunity to travel to national conferences for women in physics. These conferences are great ways to learn about research, graduate school, and physics careers, as well as network with physics majors outside of Truman.

WIP is currently inactive—during and after the pandemic, it became difficult for the physics majors to keep both SPS and WIP going. But if we have enough student interest and students wanting to take on leadership roles in WIP, it would be good to revive WIP. If you're interested, please talk to any of the Physics faculty.

2.3 Advice from Students

After spending several years in our physics programs, graduating students and experienced undergraduates offer the following advice to beginning students:

Basic Physics and Math

Introductory physics is a combination of two course sequences: College Physics I & II (PHYS 185 & 186) and Calculus for Physics I & II (PHYS 190 & 191). The College Physics courses are 4 credits each. They give you a basic overview of most of physics, but they use calculus sparingly. The Calculus for Physics courses, which are one credit each, fill in more of the math.

You should get started with College Physics as soon as possible. Unless your math background is a bit weak, so you need to get up to speed with algebra and trigonometry first, you should take PHYS 185 during your first (Fall) semester of your first year. Then, in your second (Spring) semester, you should take PHYS 190 and PHYS 186 both. You have some flexibility in how you go through a Physics major, so you have other options for timing. But then, more options mean more things to think about. If you have any questions, you shouldn't hesitate to walk into the office of any of the Physics faculty and ask for help in planning.

Math skills are essential to physics, so you should also begin the calculus sequence as early as possible: again, very often, during your first semester. Students must take Calculus I (MATH 198) before Calculus for Physics I (PHYS 190). If your math skills are weak, before calculus you should take a course such as Precalculus (MATH 186). There is a chance this may delay your graduation by a semester or two, but it's also quite possible to catch up in subsequent

semesters and graduate in four years. It needs some planning—again, you can always ask for help from the Physics faculty, even during your first year when you haven't yet been assigned an official Physics advisor.

Study Skills

Take responsibility for your own learning. One recent graduate said that his greatest regret is that he did not learn to really read a physics textbook until late in his junior year. Had he read better in his early years, he would have felt much more confident in his preparation for graduate school. Learn to read carefully and deeply. Do extra problems because they are interesting and sometimes even fun. Ask for help and advice in developing your study skills. Work together with your fellow students.

Portfolio

Some alumni have found it helpful to create and maintain a portfolio consisting of all essays and letters of application to scholarships, research positions, leadership recognition awards and universities. If available, include recommendation letters written for you by faculty, advisors, and employers. This portfolio can then be used later in developing personal statements for graduate school, summer research opportunities, and employment.

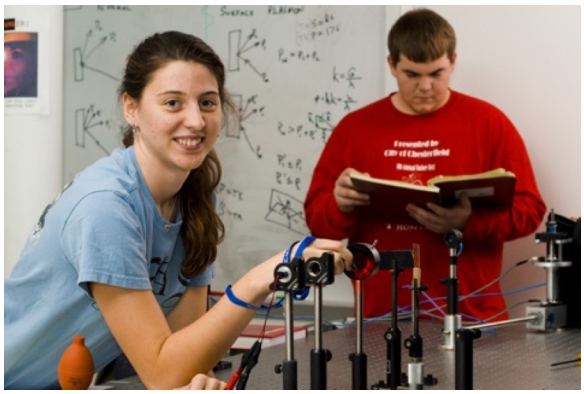
Double Majors

Many students who major in physics also major in another field. In the past, double majors included mathematics, chemistry, computer science, foreign language, music, psychology, classics, political science and philosophy. The mathematics double major is easy to set up because physics already has many math requirements. Dual majors will enhance applications for graduate school or employment. Furthermore, graduating with General Honors is easier if you complete a double-major. On the other hand, it is difficult to graduate in four years with a non-math double major.

Research Opportunities

Graduate schools place a high value on research experience when evaluating their applicants. Therefore physics majors should perform as much research on- and off-campus as possible. It is best to begin your research during your sophomore year and continue your project during your junior and senior years. Some students have done research as early as the spring semester of their freshman year. Pre-engineers are also welcome to participate in research.

Off-campus summer research opportunities, such as "Research Experiences for Undergraduates" (REU) programs, can be very exciting. Such opportunities are posted on the bulletin boards around the third floor physics area of Magruder Hall, and online.



There are numerous research opportunities available.

Presentation Opportunities

Professionals in any field are frequently called upon to give presentations relating to their research. Since practice makes perfect, you should try to give as many presentations as possible. Opportunities for students to present their work include the Student Research Conference, which takes place at Truman every spring, SPS zone meetings, meetings of the Missouri Space Grant Consortium, and the annual meeting of the National Council for Undergraduate Research (NCUR).

Physics Colloquia

Professionals also attend lots of presentations in their field. To gain experience, take the opportunity to attend as many physics and engineering-related presentations as you can, even if you don't understand everything being discussed. Listen to talks at meetings you may go to. Regularly attend all colloquia organized by the Physics Department.

Summary of Advice from Students

- Get involved in research. Talk to professors. See where their interests lie.
- Look for internships and REUs.
- Try to learn some computer programming, perhaps in your research.
- Attend physics colloquia regularly.
- Talk to upperclass students.
- Join SPS and Sigma Pi Sigma.
- Join the SPS Demo Team.

- Volunteer for SPS tutoring. It is a great way to reinforce what you learn.
- Grades aren't everything. Focus more on learning. But make sure you get good grades.
- Things will become clearer your second year. Don't freak out.
- Don't leave liberal arts courses to your last two years.
- LaTeX is good. Learn it.
- Focus on your specific interests in physics. Do you know what your interests are? Look into them.
- Map out your four year plan early.
- Start working on homework *early*.
- Review past tests. Don't be afraid to study too hard.

2.4 Advice from Physics Faculty

Dialogues Classes

It is a good idea to take the Dialogues classes as early as possible. Some of them, such as Writing as Critical Thinking (Eng 190) and Public Speaking (Comm 170), are designed to enhance skills that will support performance in other courses. In any given semester, it is best if you take the Dialogues courses for your own class level. Courses at a student's college level will usually be intellectually challenging and enjoyable. Don't wait until your senior year to take a required 100 level class!

Course Number Order

Course numbers are an indicator of difficulty but do not necessarily indicate the order in which classes need to be taken. 100 through 199 level courses are usually surveys. 200 through 299 level courses are often introductory. 300 through 499 level courses are upper-level classes. These classes cover specific topics and are usually the domain of Juniors and Seniors. 500 level and above are graduate classes, appropriate only for senior level students.

Ordinary Differential Equations

Try to take Ordinary Differential Equations (Math 365) before taking Classical Mechanics (Phys 386). Even though it is a co-requisite, a good understanding of ODE's aids in understanding many ideas in Classical Mechanics.

Linear Algebra and Quantum Mechanics

Consider taking Linear Algebra (MATH 357) before taking Quantum Mechanics (PHYS 580). Although not a prerequisite for Quantum or a Physics requirement, a working knowledge of linear algebra makes quantum mechanics easier.

2.5 Assessment

Truman has an important assessment program consisting of several tests, surveys, and a portfolio of writings gathered throughout a student's time at Truman. These instruments are a way for the university to evaluate itself, and have no effect on academic standing or on GPA. However, try to do the best you can, as the university uses these assessment tools to improve its programs. This affects not only you, but also those who follow in years to come.

Class Evaluations

Near the end of each semester, students are asked to fill out a questionnaire regarding each class they took. The questionnaire surveys students about issues like the content of the course, its organization, the effectiveness of the teaching techniques and the level of the student's participation. The evaluations are completely confidential, and the evaluation results are given to the instructor only after they have submitted the final grades. These evaluations are used by instructors to improve their teaching.

Writing Assessment

Writing is important! We want Truman students to be good writers. Writing enhances one's understanding of complex ideas. The Liberal Studies Program (LSP) requires all students to take ENG 190, Writing as Critical Thinking, and at least three additional courses designated as "writing enhanced." One of those is the required Junior Interdisciplinary Seminar (JINS) course. All physics majors satisfy a second writing enhanced requirement through PHYS 446, Advanced Lab.

Use the resources of The Writing Center in PML 107 in developing your skills. Keep a file of your writings so you can review your growth as a writer, and so you will have a sample of your work to submit in your senior portfolio.

The Portfolio

The Portfolio gives you an opportunity as a senior to look back to where you started and to reflect on your growth during your academic career. It is read by a team of faculty and used to assess the university's programs. From the beginning of the freshman year, each student is expected to save all material that reflects on his or her experiences at Truman. Examples include papers, lab reports, examinations, projects, and other works. In their senior year, students choose

and submit samples of work that are most representative of certain aspects of their education. Finally, you compose a letter reflecting on your intellectual growth while at Truman.

Major Field Test (MFT)

The Major Field Test (MFT) is a national standardized test that is taken during the senior year. It measures a student's skills and knowledge in their major, and the results are used by the discipline to improve the major. All physics majors take the physics MFT, including double majors. The test itself is a standardized multiple choice test that covers all areas in physics.

2.6 Other Physics Testing

Physics Midcourse Test

The physics discipline tests its majors on their knowledge of General Physics during Modern Physics II (Phys 251). The test does not affect any grade, but you are required to discuss the results with your physics advisor. The purpose is to identify weaknesses in the your general physics background, so they can be addressed before they prevent progress in the advanced physics courses.

Graduate Record Examination (GRE)

The Graduate Record Exam (GRE) is taken by those seniors who wish to attend graduate school and is not a requirement for all Truman students. There are two types of GRE exams: General Subject and Major Subject. The General Subject GRE measures verbal, quantitative, and analytical abilities, and can be taken online at any time for a fee. The office of Assessment and Testing on campus has further information.

Like the MFT, the Physics Subject GRE is a standardized multiple choice test that is nationally normed. The GRE may be taken numerous times in order to improve your score. It is offered three times each year, in September, October, and April. The use of the GRE as an entrance requirement varies amongst graduate schools. You should check with the graduate schools you intend to apply to before taking the exam.

2.7 Useful Websites

Truman Physics	physics.truman.edu
Society of Physics Students	sps.truman.edu
Women in Physics	wip.truman.edu
Stargazers	stargazers.truman.edu
Truman Observatory	observatory.truman.edu
Sigma Pi Sigma	www.sigmapisigma.org
General / Graduate Catalog	catalog.truman.edu

2.8 Physics Students Mailing List

Physics students can keep up to date on what going on in the department by joining the mailing list `phys-students@truman.edu` (email edis@truman.edu to get on it). You will get notified of SPS meetings, scholarship and research opportunities, upcoming colloquia, and other useful stuff. All physics majors are assumed to be on this list to get this news, so make sure you're on it.

As a result of a cyber-attack on Truman in 2023, the student email list was still inoperative when this handbook was updated. You'll hear about it when it gets going again.

Chapter 3

Physics Program

3.1 Programs and Tracks

For physics majors (not the pre-engineers) Truman offers two programs: the BS (Bachelor of Science) and BA (Bachelor of Arts). You will decide which option is best for you, but there is no rush. For your first two years there is no significant difference between the BS and the BA, or any of the tracks within the BS.

BS, General Physics Track

The BS degree in Physics is designed for students planning to continue their physics and astronomy studies in graduate school. The General Physics track involves taking pretty much every physics course offered, with the exception of a few astrophysics courses. You get trained for entering and succeeding in a good graduate school. This usually leads to a physics-related career.

In other words, the General Physics track is kind of a default option for physics. You look at the Physics course catalog, and assume that you're going to take almost all of those courses at some point during your undergraduate career. You will likely (but not necessarily) go to graduate school, and it's only there that you will begin to specialize in a physics-related subdiscipline. Your undergraduate education will be focused on the foundational knowledge common to all physicists, no matter what their specialization.

BS, Astrophysics Track

Students on the Astrophysics track take specific astrophysics courses, plus a selection from upper-level physics courses as electives. This prepares you for graduate school in astronomy and astrophysics.

The differences between the Astrophysics and General Physics track are not large. You take four astrophysics courses: either Introduction to Astronomy or Solar System Astronomy (PHYS 131 or 132), Stellar Astrophysics (PHYS 331),

Galactic Astrophysics (PHYS 331), and Observational Astronomy (PHYS 346). You also take fewer of the upper-level physics courses required for the General track. You can take a couple of the astrophysics courses in your first two years, but the more significant differences in coursework kick in during your third and fourth years.

The BA

The BA in Physics is for students who want a rigorous undergraduate experience in physics, but who are not necessarily planning a career in physics or astronomy. The strong focus on mathematical modeling, problem solving, and the ability to work and learn independently make a degree in physics from Truman an excellent preparation for a variety of non-physics career paths such as law or medical school, secondary school teaching, or work in industry.

After introductory Physics and Calculus, BA students take Modern Physics, and then choose at least 9 hours from among more advanced topics such as Electronics, Classical Mechanics, Advanced Laboratory, Electromagnetism, Statistical Mechanics, and Quantum Mechanics. BA candidates must also design their own 15 hour Learning Plan outside of physics—this could, for example, be a minor in another discipline. The BA also requires intermediate proficiency in a foreign language, while elementary proficiency is sufficient for a BS.

Recent graduates from Truman's physics program have gone on to work in many different fields, such as in energy and environmental policy, in medicine, in the environmental clean-up industry and in the entertainment software industry.

3.2 General Requirements

Credit Hours

A BS in physics consists of about 72 hours of physics-related course work and an additional 31 to 57 hours to satisfy the Liberal Studies Program (LSP) and other graduation requirements. Students need an average of 15 credit hours per semester to graduate with the minimum of 120 total credit hours.

A BA in physics includes 51 hours of physics-related course work, a 15-hour Learning Plan or a minor (or second major) that must be pre-approved by a committee of three physics faculty members, and an additional 31 to 57 hours to satisfy the Liberal Studies Program (LSP) and other graduation requirements.

3.2.1 Applying for Graduation

An undergraduate student should file an application for the degree after completing 90 credit hours. Graduation requirements and the application process are detailed in the Truman General/Graduate Catalog (catalog.truman.edu).

Physics 320 (Electronics).

Additional Information

In addition to the items stated previously, candidates should take note of the following:

- Off-campus and correspondence courses taken during the final semester must be cleared with the Vice President for Academic Affairs, the advisor, the physics chair, and the Registrar.
- For all repeated courses, a repeat form must be filed with the Registrar's Office.
- Course substitutions must be approved through your advisor, the physics chair, and the Vice President for Academic Affairs.
- If you are graduating in absentia, you must notify the Vice President for Academic Affairs.

3.3 Honors Curriculum

Departmental Honors

Honors in Physics are awarded to all graduating physics majors who meet at least one of the following two requirements: (a) A grade point average in the physics courses required for the major which equals or exceeds 3.5, and a score at or above the 90th percentile in the Physics Major Field Achievement Test, or (b) A grade point average in the major requirements which equals or exceeds 3.75 and a score at or above the 80th percentile in the Physics Major Field Achievement Test.

Honors Scholars Program

To be recognized as an Honors Scholar in the Arts and Sciences, graduating seniors must have completed five approved courses, with at least one course from each of the areas of mathematics, science, humanities, and social science, and with a cumulative grade point average of at least 3.5. Only grades of "A" and "B" may count toward the Honors Scholar grade point average requirements of at least 3.5 in those five courses and students must have an overall grade point average of 3.5. Also, only courses with three or more credit hours may count toward becoming an Honors Scholar. Students who complete a single undergraduate major may not satisfy Honors Scholar requirements with any course in their major field.

3.4 Other Physics-related Programs

Minor in Physics

An academic minor provides contrasting and parallel study to the major. Serving to complement the major and help students further expand and integrate knowledge, academic minors are offered in a variety of disciplinary and interdisciplinary subjects. If you choose to pursue a minor, you should seek advice from faculty members in your minor disciplines, as well as from your major advisor. Students minoring in physics are welcomed as full members in the community of physics faculty and students.

The Physics Minor requires:

PHYS 185	College Physics I	(4 credits)
PHYS 186	College Physics II	(4 credits)
PHYS 190	Calculus for Physics I	(1 credit)
PHYS 191	Calculus for Physics II	(1 credit)
PHYS 250	Modern Physics I	(3 credits)
PHYS 375	Vibrations and Waves	(3 credits)
OR		
PHYS 382	Mathematical Physics	(3 credits)

and an additional 3 hours from any PHYS courses at the 300, 400, or 500 level; or PHYS 245 (Meteorology).

Please note that these courses have additional prerequisites such as calculus.

Minor in Astronomy

The Astronomy Minor requires:

PHYS 185 or 186	College Physics I or II	(4 credits)
PHYS 131 or 132	Introduction to Astronomy or Introduction to Solar System Astronomy	(4 credits)
PHYS 132	Solar System Astronomy	(4 credits)
PHYS 346	Observational Astronomy	(4 credits)

Double Majors

You should be aware that since physics requires intense mathematical studies, physics majors need only a few extra classes to also obtain a degree in mathematics.

Master of Arts in Education (MAE)

The Master of Arts in Education (MAE) Program prepares students to teach at the elementary or secondary level after completing an undergraduate major and the MAE Program. To facilitate a timely admittance to the MAE program, physics majors must plan their coursework following preestablished guidelines. Undergraduate students will maintain contact with the Department of Education through organizations, coursework, newsletters, and their own initiative. During each undergraduate year, students become more involved with the education program until they are ready to apply for admission to the Master of Arts in Education program during their senior year.

In addition to the general undergraduate certification requirement, the Missouri State Department of Education establishes subject-matter requirements to meet standards for teaching in public schools in Missouri. These subject-matter requirements are not automatically fulfilled in all majors at Truman State University. Students who plan to apply for admission to the Master of Arts in Education Program will be required to fulfill subject-matter teaching requirements in their chosen field. For additional information, students should visit with the Certification Officer in the Department of Education. Visit `education.truman.edu` to find out more.

Certification requirements for teaching in Missouri can be found in the Education Department's section of the General Bulletin.

Chapter 4

Pre-Engineering and Dual Degree Programs

For the first two years, the courses taken by both physics and pre-engineering majors are nearly identical.

4.1 Pre-Engineering Program

Truman State University offers a pre-engineering program in which a student attends Truman for two years and then transfers to an engineering school of their choice. During their stay at Truman, pre-engineers take a mathematics sequence consisting of Calculus I, II, and III and Ordinary Differential Equations (Math 198, 263, 264 and 365), a calculus-based introductory physics sequence: College Physics I and II (Phys 185 and 186) and Calculus for Physics I and II (Phys 190 and 191); and General Chemistry I (Chem 130). Courses in English, Communications, the Humanities and Social Sciences make up the rest of their course load [for example, Writing as Critical Thinking (Eng 190), Public Speaking (Comm 170), Macro- or Microeconomics, U.S. History].

4.2 Accreditation

Most good engineering programs are accredited by the Accrediting Board of Engineering and Technology (ABET). For example, licensing requirements in the state of Missouri include an engineering degree awarded by an ABET accredited program (the accreditation is given to individual programs within a school, not to the school). The guidelines for accreditation are strict, which make the curricula of different engineering schools very similar, and include specific regulations for the general education requirements.

4.3 Transfer Agreement

In designing the curriculum for pre-engineers, we take into account ABET guidelines, as well as the models presented by the Missouri University of Science and Technology (Rolla) and The University of Missouri—Columbia. Rolla and Mizzou are high quality engineering schools with which Truman has transfer agreements. When students come to Truman, they can simultaneously apply to Rolla. Enrolling in their Transfer Assistance Program ensures that students will have a smooth transition. Not all students transfer to Rolla or Columbia; many attend institutions outside of Missouri.

Why should a student enroll in our pre-engineering program instead of attending an engineering school for four years? Some students are not firmly decided that they would like to be engineers. For students inclined to explore their options, a liberal arts and sciences institution like Truman offers a tremendous array of opportunities, often not available in engineering schools. Truman is also more diverse; students are able to interact with people who have many different interests. Classes are small and a strong emphasis is placed on the interaction between faculty and students both in and out of the classroom. The class size for the engineering courses offered at Truman is typically less than a dozen students.

The physics faculty are well informed about the needs of pre-engineers and can assist in planning for engineering school. During the two years at Truman, pre-engineers enroll in many of the general education courses that are required of all majors, so if they decide to change majors, there will be no loss of time.

4.4 Dual Degree Program

The Truman Physics Department also offers a Dual Degree program. If you do a dual degree you will take an extra year to complete your undergraduate studies, but you will then graduate with two degrees: a B.A. in Physics from Truman and an engineering degree from another institution.

You spend your first three years at Truman, taking most of the courses required for a B.A. in Physics as well as all the courses and commitments required for any Truman undergraduate B.A. degree (i.e., LSP courses, foreign language proficiency and assessment requirements). You then transfer to another university to complete the remainder of your engineering degree. Truman courses transfer to the second institution, fulfilling its course requirements for the first two years, and some of the advanced engineering courses transfer back to Truman to finish up the B.A. Physics requirements. At the end, you have two degrees, making you better prepared than most for an advanced technical job or for graduate study.

The dual degree program requires careful scheduling, and so it is best if you decide early that you want to pursue this challenging and rewarding course of study. If you are interested in the Dual Degree program, inquire about it with your physics advisor or any of the physics faculty.

Dual Degree with Washington University

Truman has a special agreement with Washington University in St Louis for our students to complete the engineering part of their dual degree. Students might find this a particularly attractive option. For details, please get in touch with Tim Wiser, tdwiser@truman.edu.

Chapter 5

Physics Faculty

The year in parentheses indicates the year hired at Truman State University.

Colin DeGraf
Assistant Professor of Physics (2021)
— B.S., Worcester Polytechnic Institute
— Ph.D., Carnegie Mellon University
MG 3170 | (660) 785-4070
cdegraf@truman.edu

Taner Edis
Professor of Physics (2000)
— B.S., Boğaziçi University
— Ph.D., The Johns Hopkins University
MG 3004 | (660) 785-4583
edis@truman.edu
`edis.sites.truman.edu`

Vayujeet Gokhale
Professor of Physics (2007)
— B.Sc., University of Bombay, India
— Ph.D., Louisiana State University
MG 3168 | (660) 785-4594
gokhale@truman.edu
`gokhale.sites.truman.edu`

Rasanjali Jayathissa
Assistant Professor of Physics (2023)
— B.S., University of Peradeniya
— Ph.D., Western Michigan University
MG 3166 | (660) 785-4613
rjaya@truman.edu

Timothy D. Wiser
Assistant Professor of Physics (2018)
— B.S., Washington University in St Louis
— Ph.D., Stanford University
MG 3174 | (660) 785-4603
tdwiser@truman.edu

Chapter 6

Curriculum Summaries

6.1 Checking Your Degree Progress

Use a degree worksheet to plan your courses. You may locate a degree worksheet for your major at catalog.truman.edu. There are also sample four-year plans at excellence.truman.edu.

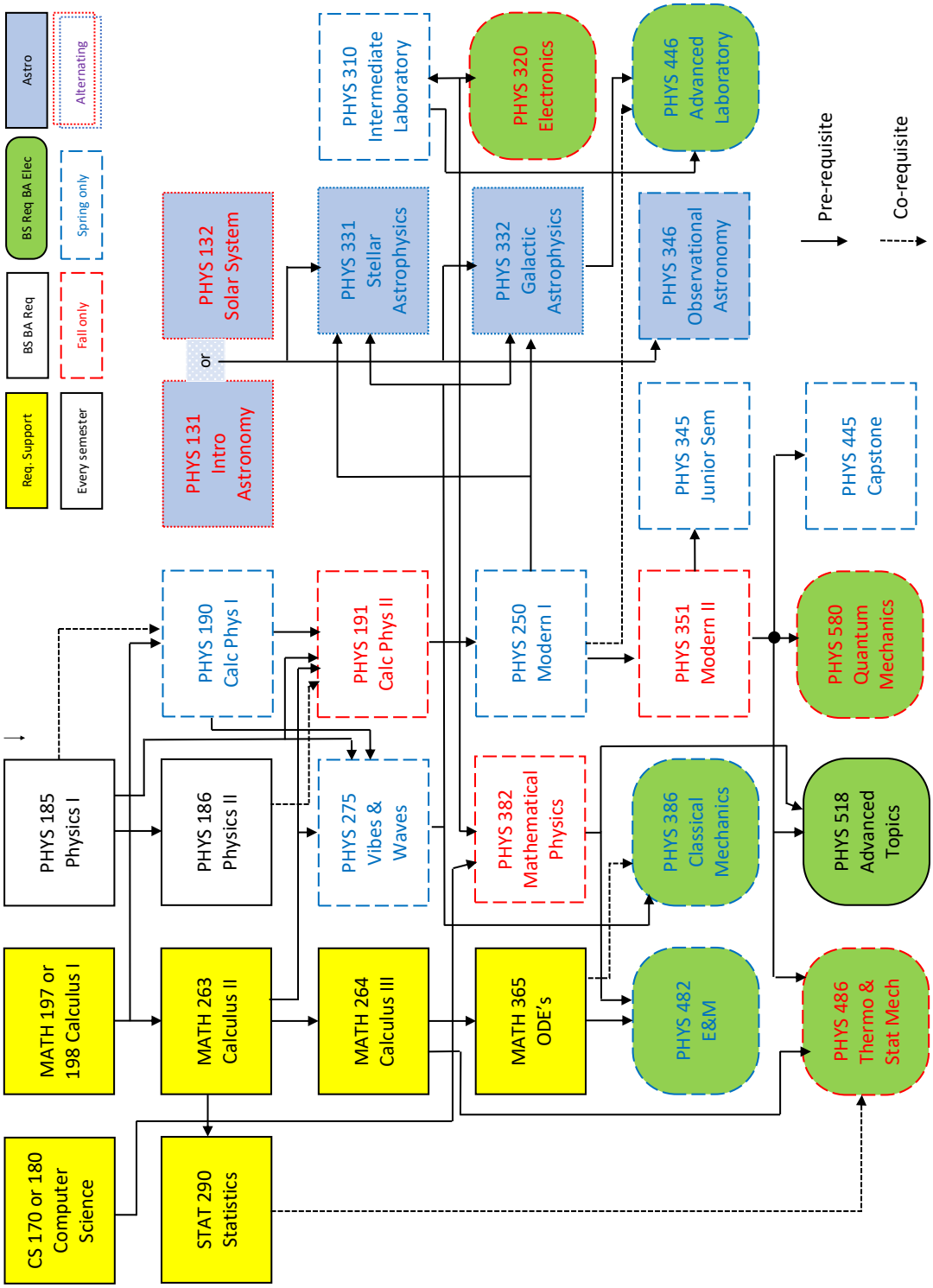
From time to time, you should check on your course progress by using DegreeWorks, accessed through TruView.

6.2 Tables and Visual Aids

The following summary pages represent the best and most up-to-date knowledge of the physics faculty, but please remember that the faculty are not infallible. They are useful guides, but should not be considered official documents.

- Page 24
  - Tatsuya Akiba's flow chart for prerequisites and requirements.
- Page 25 and 26
  - Summary of required courses for the Physics B.S., both tracks; and the Physics B.A. and the minors.
- Pages 27 to 30
  - Common Physics, Math, and Chemistry course sequences organized by semester for physics and engineering majors in different situations.

You are allowed to use any set of graduation requirements that were approved from the time of your enrollment at Truman until the time you graduate. When applying for graduation, you will be asked which year's General Bulletin contains the program under which you want to graduate.


Astro
Alternating
BS Req BA Elec
Spring only
BS BA Req
Fall only
Req. Support
Every semester
Pre-requisite
Co-requisite
PHYS 185 Physics I
PHYS 186 Physics II
PHYS 190 Calc Phys I
PHYS 191 Calc Phys II
PHYS 250 Modern I
PHYS 275 Vibes & Waves
PHYS 310 Intermediate Laboratory
PHYS 320 Electronics
PHYS 331 Stellar Astrophysics
PHYS 332 Galactic Astrophysics
PHYS 345 Junior Sem
PHYS 346 Observational Astronomy
PHYS 351 Modern II
PHYS 382 Mathematical Physics
PHYS 386 Classical Mechanics
PHYS 445 Capstone
PHYS 446 Advanced Laboratory
PHYS 482 E&M
PHYS 486 Thermo & Stat Mech
PHYS 518 Advanced Topics
PHYS 580 Quantum Mechanics
PHYS 131 Intro Astronomy
or
PHYS 132 Solar System
MATH 197 or 198 Calculus I
MATH 263 Calculus II
MATH 264 Calculus III
MATH 365 ODE's
CS 170 or 180 Computer Science
STAT 290 Statistics

	BS, General Physics Track			BS, Astrophysics Track			
	Calculus I	198	5	Calculus I	198	5	
Required	Calculus II	263	4	Calculus II	263	4	Required
Support	Calculus III	264	4	Calculus III	264	4	Support
	ODE	365	3	ODE	365	3	
	Statistics	290	3	Statistics	290	3	
	Computer Science	170/180	4	Computer Science	170/180	4	
	College Physics I	185	4	College Physics I	185	4	
	College Physics II	186	4	College Physics II	186	4	
	Calc Physics I	190	1	Calc Physics I	190	1	
	Calc Physics II	191	1	Calc Physics II	191	1	
	Modern I	250	3	Modern I	250	3	
	Modern II	251	3	Modern II	251	3	Core
	Intermediate Lab	310	2	Intermediate Lab	310	2	Reqs
	Electronics	320	3	Junior Seminar	345	1	
	Junior Seminar	345	1	Vibrations & Waves	375	3	
	Vibrations & Waves	375	3	Math Physics	382	3	
	Math Physics	382	3	Physics Capstone	445	2	
Major	Classical	386	3				
Reqs	Advanced Lab	446	3	Intro Astronomy	131/132	4	
	E&M	482	3	Stellar Astrophysics	331	3	Astro
	Thermodynamics	486	3	Galactic Astrophysics	332	3	Reqs
	Physics Capstone	445	2	Observational Astro	346	4	
	Advanced Topics	518	3				
	Quantum Mechanics	580	3	Electronics	320	3	Physics
				Classical	386	3	Electives
	TOTAL =		**71**	E&M	482	3	(9 hrs)
				Thermodynamics	486	3	
				TOTAL =		**73**	

BA in Physics

Calculus I	198	5	Required Support
Calculus II	263	4	
Calculus III	264	4	
ODE	365	3	
Statistics	290	3	
Computer Science	170/180	4	
College Physics I	185	4	Major Reqs
College Physics II	186	4	
Calc Physics I	190	1	
Calc Physics II	191	1	
Modern I	250	3	
Modern II	251	3	
Intermediate Lab	310	2	
Junior Seminar	345	1	
Vibrations & Waves	375	3	
Math Physics	382	3	
Physics Capstone	445	2	
Electronics	320	3	Physics Electives (9 hrs)
Classical	386	3	
Advanced Lab	446	3	
E&M	482	3	
Thermodynamics	486	3	
Advanced Topics	518	3	
Quantum Mechanics	580	3	
Foreign Language		0 - 6	BA Req
Learning Plan		15	
TOTAL =		**74-80**	

Physics Minor

College Physics I	185	4
College Physics II	186	4
Calc Physics I	190	1
Calc Physics II	191	1
Modern I	250	3
Vibrations & Waves	375	3
OR		
Mathematical Physics	382	3
Physics Elective		3
(245, any 300-500 level)		
TOTAL =		**19**

Astronomy Minor

College Physics I or II	185/186	4
Intro Astronomy	131	4
Solar System	132	4
Observ Astronomy	346	4
TOTAL =		**16**

BS, General Physics Track — Start with Calculus I

	FALL	credits	SPRING	credits
1	College Physics I	4	College Physics II	4
	Calculus I	5	Calc Physics I	1
	Phys/Math credits =	*9*	Calculus II	4
			Phys/Math credits =	*9*
2	Calc Physics II	1	Modern I	3
	Calculus III	4	Intermediate Lab	2
	Statistics	3	Vibs & Waves	3
	Computer Science	4	ODE	*3*
	Phys/Math credits =	*12*	*Phys/Math credits =*	*11*
3	Modern II	3	Classical	3
	Electronics	3	Advanced Lab	3
	Math Physics	3	Junior Seminar	1
	Phys/Math credits =	*9*	*Phys/Math credits =*	*7*
4	Quantum	3	Advanced Topics	3
	Thermodynamics	3	E&M	3
	Phys/Math credits =	*6*	Capstone	2
			Phys/Math credits =	*8*

BS, General Physics Track — Start with Calculus II

	FALL	credits	SPRING	credits
1	College Physics I	4	Vibs & Waves	3
	Calculus II	4	Calculus III	4
	Phys/Math credits =	*8*	College Physics II	4
			Calc Physics I	1
			Phys/Math credits =	*12*
2	Calc Physics II	1	Modern I	3
	ODE	3	Intermediate Lab	2
	Computer Science	4	Statistics	3
	Phys/Math credits =	*8*	*Phys/Math credits =*	*8*
3	Modern II	3	Classical	3
	Electronics	3	Advanced Lab	3
	Math Physics	3	Junior Seminar	1
	Phys/Math credits =	*9*	*Phys/Math credits =*	*7*
4	Quantum	3	Advanced Topics	3
	Thermodynamics	3	E&M	3
	Phys/Math credits =	*6*	Capstone	2
			Phys/Math credits =	*8*

BS, Astrophysics Track — Start with Calculus I

	FALL	credits	SPRING	credits
1	College Physics I	4	College Physics II	4
	Calculus I	5	Calc Physics I	1
	Astro | Solar Sys	4	Calculus II	4
	Phys/Math credits =	*13*	*Phys/Math credits =*	*9*
2	Calc Physics II	1	Modern I	3
	Calculus III	4	Intermediate Lab	2
	Statistics	3	Vibs & Waves	3
	Computer Science	4	ODE	*3*
	Phys/Math credits =	*12*	*Phys/Math credits =*	*11*
3	Modern II	3	Physics Elective	3
	Math Physics	3	Stellar | Galactic	3
	Phys/Math credits =	*6*	Junior Seminar	1
			Phys/Math credits =	*7*
4	Physics Elective	3	Galactic | Stellar	3
	Physics Elective	3	Obs Astronomy	4
	Phys/Math credits =	*6*	Capstone	2
			Phys/Math credits =	*9*

BS, Astrophysics Track — Start with Calculus II

	FALL	credits	SPRING	credits
1	College Physics I	4	Vibs & Waves	3
	Calculus II	4	Calculus III	4
	Astro | Solar Sys	4	College Physics II	4
	Phys/Math credits =	*12*	Calc Physics I	1
			Phys/Math credits =	*12*
2	Calc Physics II	1	Modern I	3
	ODE	3	Intermediate Lab	2
	Computer Science	4	Statistics	3
	Phys/Math credits =	*8*	*Phys/Math credits =*	*8*
3	Modern II	3	Physics Elective	3
	Math Physics	3	Stellar | Galactic	3
	Phys/Math credits =	*6*	Junior Seminar	1
			Phys/Math credits =	*7*
4	Physics Elective	3	Galactic | Stellar	3
	Physics Elective	3	Obs Astronomy	4
	Phys/Math credits =	*6*	Capstone	2
			Phys/Math credits =	*9*

BA — Start with Calculus I

	FALL	credits	SPRING	credits
1	College Physics I	4	College Physics II	4
	Calculus I	5	Calc Physics I	1
	Phys/Math credits =	*9*	Calculus II	4
			Phys/Math credits =	*9*
2	Calc Physics II	1	Modern I	3
	Calculus III	4	Intermediate Lab	2
	Statistics	3	Vibs & Waves	3
	Computer Science	4	ODE	*3*
	Phys/Math credits =	*12*	*Phys/Math credits =*	*11*
3	Modern II	3	Physics Elective	3
	Math Physics	3	Junior Seminar	1
	Phys/Math credits =	*6*	*Phys/Math credits =*	*4*
4	Physics Elective	3	Capstone	2
	Phys/Math credits =	*3*	Physics Elective	3
			Phys/Math credits =	*5*

BA — Start with Calculus II

	FALL	credits	SPRING	credits
1	College Physics I	4	Vibs & Waves	3
	Calculus II	4	Calculus III	4
	Phys/Math credits =	*8*	College Physics II	4
			Calc Physics I	1
			Phys/Math credits =	*12*
2	Calc Physics II	1	Modern I	3
	ODE	3	Intermediate Lab	2
	Computer Science	4	Statistics	3
	Phys/Math credits =	*8*	*Phys/Math credits =*	*8*
3	Modern II	3	Physics Elective	3
	Math Physics	3	Junior Seminar	1
	Phys/Math credits =	*6*	*Phys/Math credits =*	*4*
4	Physics Elective	3	Capstone	1
	Phys/Math credits =	*3*	Physics Elective	3
			Phys/Math credits =	*4*

Dual Degree — Start with Calculus I

	FALL	credits	SPRING	credits
1	College Physics I	4	College Physics II	4
	Calculus I	5	Calc Physics I	1
	Computer Science	4	Calculus II	4
2	Calc Physics II	1	Modern I	3
	Calculus III	4	Intermediate Lab	2
	Statistics	3	Vibs & Waves	3
			ODE	3
3	Modern II	3	Physics Elective	3
	Math Physics	3	Junior Seminar	1
			Capstone	2

Dual Degree — Start with Calculus II

	FALL	credits	SPRING	credits
1	College Physics I	4	College Physics II	4
	Calculus II	4	Calc Physics I	1
	Computer Science	4	Calculus III	4
2	Calc Physics II	1	Modern I	3
	ODE	3	Intermediate Lab	2
	Statistics	3	Vibs & Waves	3
3	Modern II	3	Physics Elective	3
	Math Physics	3	Junior Seminar	1
			Capstone	2

Pre-Engineers — Start with Calculus I

	FALL	credits	SPRING	credits
1	College Physics I	4	College Physics II	4
	Calculus I	5	Calc Physics I	1
			Calculus II	4
2	Calc Physics II	1	Chemistry I	4
	Calculus III	4	ODE	3
	Statistics	3	Computer Science	4

Pre-Engineers — Start with Calculus II

	FALL	credits	SPRING	credits
1	College Physics I	4	College Physics II	4
	Calculus II	4	Calc Physics I	1
			Calculus III	4
	Calc Physics II	1	Computer Science	4