

SPRING 2025 Physics 4323-101

Instructor: Halyna Hodovanets 118 Physics halyna.hodovanets@mst.edu

Meeting room and time: Physics 00127 MWF 11:00-11:50 AM

Help Sessions: TBA

Webpage: Canvas

Textbook: Introduction to solid state physics, 8th Ed., Charles Kittel

Additional books:

G. Burns "Solid State Physics"

C. Kittel "Quantum Theory of Solids"

N.W. Ashcroft and N.D. Mermin "Solid State Physics"

J. M. Ziman "Principles of the Theory of Solids"

J. Callaway "Quantum Theory of the Solid State"

Description of the course:

This course covers the basics of physics of crystalline materials. You will become familiar with the concepts and terminology of crystal structure, lattice vibration, band structure, magnetism, and superconductivity. You will also learn about the physical and thermal properties of materials and how to measure them.

Objectives of the course:

- To increase understanding of solid-state physics and physics of materials
- To lay the foundation for the future studies and/or research in the areas of condensed matter physics
- To become proficient with the basic calculation methods and improve your problem-solving ability

How to engage with the course and succeed

To do well in the course: come to lectures, read the textbook, work diligently on homework either by themselves or in groups, and come to the help sessions.

Topics to be covered in order listed:

- Classification of solids and crystal structures
- Crystallographic techniques: diffraction
- Crystal binding; elastic properties
- Lattice vibrations (phonons I)
- Thermal properties (phonons II)
- Electronic properties of metals. Free electron Fermi gas
- Nearly-free electron model; energy bands, band gaps
- Semiconductors
- Metals; Fermi surface; Tight-binding model
- Superconductivity (intro to BCS theory)

Final Exam (cumulative) Monday May 14th 2025 at 7:30 AM-9:30 AM

N. B. According to the Student Academic Regulations all requests to change the final schedule because of conflicts or having three or more examinations scheduled on one day "are to be made in the Registrar's Office at least one week before the beginning of the final examination week", starting Monday, April 21 and ending on Friday, May 2.

Final grade make up:

Homework (10 assignments)	40%
Exam 1-3	35%
Final (cumulative)	25%

Homework:

- During Friday class you will be assigned a problem set, which will consist of the end-of-the-chapter problem(s), and questions based on the chapter objectives.
- Neatly handwritten or typed solutions are due on Wednesday (submitted on Canvas) of the following week.
- Homework will be accepted only until the end of the class on Friday of the due week (with 50% penalty for turning the assignment after the deadline).
- At the end of the course one lowest homework grade will be dropped.
- You are encouraged to discuss your homework in groups. However, identical homework solutions will be given a grade zero. Homework created by using ChatGPT or any AI tools need to be clearly labeled as such. Homework solved completely using the AI will be given a grade 0.

Midterm and final exams:

- Midterm exams will be given during a regular class time.
- The cumulative Final exam will be given in our regular lecture room.
- The midterm and the final exams will consist of a few problems like homework.
- Tests are open notes (*your written notes only!*) format. No textbook, no electronic notes are allowed.
- The lowest out of three midterm exam scores may be dropped.

Test makeup policy:

- In exceptional cases of documented medical or personal emergencies, a makeup test will be provided.
- The instructor **MUST** be notified of such an emergency **PIOR** to the test.
- A makeup test will be composed using the same guidelines as the test missed.

Sick policy: For any respiratory illness, COVID-19 and influenza in particular, the new recommendations suggest returning to normal activities when:

- Symptoms have been improving overall for at least 24 hours, and
- If fever is present, no fever for 24 hours without the use of fever-reducing medication.

Students who are ill are advised to be seen at Student Health Services. Students can schedule appointments by calling (573) 341-4284 or online through their patient portal.

If you are ill, protect others around you by:

- Practicing good hygiene: cover your coughs and sneezes, wash or sanitize hands often, and clean frequently touched surfaces.
- Stay away from others until you are feeling better, particularly if they are immunocompromised.

Should you feel unwell, ill or are unable to attend class or take tests on campus in addition to contacting Student Health Services please notify the instructor, and do not come to the lecture. The homework due time will not be postponed unless the student is sick for more than a week. In the case the student is sick when the exam is taking place, that exam (except final) will count as the lowest score exam and will be dropped. The instructor must be notified *prior* to the exam.

Excessive absence:

- If you miss 3 assignments of any kind, an academic alert will be issued
- If you miss 5 assignments and/or 2 exams you will be dropped from the course for excessive absence

Final Grade: The letter grades will be assigned based on the following cut offs (to four significant figures):

- A - 89.50% of total possible points
- B - 79.50% of total possible points
- C - 69.50% of total possible points
- D - 59.50% of total possible points
- F - less than 59.50% of possible points

The grade cuts are absolute and will not be lowered. Points will not be added to a student's grade to bring it above the cutoff.

In the event of instructor emergency: All class meetings will be held via ZOOM synchronously, and all assignments will continue as scheduled. Exams will be held via ZOOM as well. The web-camera will be required to show the work area for proctoring.

Statement about Copyright, FERPA, and Use of Video

It is vitally important that our classroom environment promote the respectful exchange of ideas. This entails being sensitive to the views and beliefs expressed during discussions, whether in class or online. Please obtain instructor permission before recording any class activity. It is a violation of University of Missouri policy to distribute such recordings without authorization and the permission of all who are recorded. More information is provided online.

Accessibility and Accommodations

It is the university's goal that learning experiences be as accessible as possible. Student Accessibility and Testing provides services and accommodations that facilitate full participation in Missouri S&T's learning experience for students with disabilities. If you anticipate or experience physical, academic, and/or digital barriers due to a disability, please contact Student Accessibility and Testing at (573) 341-6655, email dss@mst.edu, or visit <https://saat.mst.edu/> for information.

Student Honor Code and Academic Integrity

- All students are expected to follow the Standard of Conduct and Honor Code.
- The Standard of Conduct defines the behavioral expectations of all students and student organizations with clear descriptions designed to protect a specialized educational environment conducive to learning. This environment promotes learning while fostering integrity, academic success, personal and professional growth, and responsible citizenship.
- Additional resources regarding academic integrity are available online.

Student Mental Health and Well-Being

Your well-being is important, and it contributes to your success in this course. At S&T, we provide resources to support your mental, physical, and social well-being. Any of us can experience challenges that make learning difficult. If you are struggling, take advantage of the following resources offered by the university:

Student Well-Being (<https://wellbeing.mst.edu/>)

Student Well-Being provides counseling services, health promotion initiatives, and prevention programs to empower the S&T community to thrive and enhance personal, academic, and professional success. Department office hours are Monday-Friday, 8 a.m. – 4:30 p.m. On the website, you can find information related to confidential individual and group counseling, wellness consultations and trainings, case management services, resources for many health and wellness topics, and help for mental health crisis situations. For the 988 Suicide and Crisis Lifeline, call or text 988, or visit missouri988.org.

Health and Well-Being Canvas Course (<https://umsystem.instructure.com/enroll/G3LY3G>)

The Health and Well-Being Canvas Course features trainings, presentations, and other health and well-being resources for students. The course is free for all students, is non-credit, and students can enroll at any point in the semester.

Student Emergency Fund (SEF)

The SEF is administered by the Division of Student Success to help ensure Missouri S&T students have access to the support and resources they need to successfully recover from an unforeseeable financial emergency. The goal of this fund is to prevent one small emergency or unexpected expense from derailing a student's progress toward degree completion.

Nondiscrimination, Equity, and Title IX

Missouri S&T is committed to the safety and well-being of our campus community, and to creating an environment free from discrimination and harassment.

The University prohibits discrimination and harassment on the basis of race, color, national origin, ancestry, religion, sex, pregnancy, sexual orientation, gender identity, gender expression, age, disability, protected veteran status, and any other status protected by applicable state or federal law. As used in this policy, the word “sex” is also inclusive of the term “gender.”

Additionally, US Federal Law Title IX states that no member of the university community shall, on the basis of sex, be excluded from participation in, or be denied benefits of, or be subjected to discrimination under any education program or activity. Sexual harassment violations of this law include quid pro quo, hostile environment, sexual assault, dating/domestic violence, and stalking. The U.S. Department of Education has stated the prohibition on discrimination on the basis of sex includes sexual orientation and gender identity.

Students who are experiencing pregnancy or pregnancy-related conditions, including the birthing parent and non-birthing parent, have rights protected under Title IX. Students should contact Student Accessibility and Testing or the Office of Equity and Title IX to learn more about their rights and pregnancy-related assistance/accommodations provided by the University to ensure equitable access to University educational programs and activities.

In accordance with the University of Missouri’s Collected Rules and Regulations, all faculty and staff are required to report any information concerning discrimination disclosed through communication including, but not limited to, direct conversation, email, social media, classroom papers and homework exercises to the Equity Officer/Title IX Coordinator.

For more information regarding support for those that have been impacted or to report an incident of discrimination or harassment as defined by Chapter 600 of the University’s Collected Rules and Regulations, visit the Office of Equity and Title IX or visit their website at equity.mst.edu.

Office of Equity and Title IX

Equity Officer and Title IX Coordinator: Dr. Paul Hirtz

Phone: (573) 341-7734

Location: 900 Innovation Drive, Suite 500

E-mail: equity@mst.edu

Classroom Egress Maps

For all in-person instruction, faculty should explain where the classroom emergency exits are located. Classroom egress maps are posted at <http://designconstruction.mst.edu/floorplan/>.

University Libraries

The library provides students and faculty with physical and electronic books, journals, articles and databases as well as recreational reading and video materials. You can also check out laptops, calculators, tool kits and more and reserve study or meeting rooms. Talk to us one-on-one via chat, email, phone or in person for any assistance regarding library services or finding peer-reviewed, credible research materials for study and research needs. Find out more information about the library here: library.mst.edu.

Writing and Communication Center

The Writing and Communication Center's mission is to assist all students in their efforts to become better writers, communicators, and critical thinkers. The Center's peer consultants and coaches provide free individualized one-on-one and small-group conversations to offer meaningful feedback and guidance to students across all disciplines. More information can be found on our website, through email: writing@mst.edu or stop by Curtis Laws Wilson Library 314–315.

Student Success Center

The Student Success Center (SSC) offers peer tutoring and success coaching to help students succeed in their academic goals. Additionally, we work as a resource hub and can connect you to the campus resources necessary to help you dig deeper and finish the semester strong. Visit the SSC in Room 117 Innovation Lab and contact us at ssc@mst.edu or 573-341-7590. To learn more about the SSC, visit <https://ssc.mst.edu/>

S&T Tutoring Opportunities

The Student Success Center (SSC) helps you with your studies in three ways:

- **LEAD Drop-in:** Our LEAD Drop-in service provides convenient access to experienced peer learning assistants for a multitude of courses across campus. No appointments necessary. Simply check our tutoring schedule to discover when support for your specific course is available: <https://ssc.mst.edu/leaddrop-in/>
- **LEAD Group Sessions:** Our LEAD Group sessions offer after-hours group tutoring, facilitated by our dedicated peer learning assistants in partnership with faculty members. Explore the LEAD Group schedule to see if your course is featured and join us at the next session: <https://ssc.mst.edu/leadgroup/>
- **Knack Tutoring:** If your schedule clashes with our LEAD offerings, or if your course isn't covered, Knack is your solution. Request a tutor for either a virtual meeting or an in-person session on campus, ensuring you get the help you need, when you need it. To sign up for your FREE Knack account, visit: <https://ssc.mst.edu/knacktutoring/>

Military & Veterans Services Center (MVSC)

The Military & Veteran Services Center at Missouri S&T is dedicated to supporting those who have served, are currently serving, and those who aspire to serve in our nation's armed forces, along with their families. We are committed to fostering a welcoming and inclusive environment that empowers military-connected students to achieve their educational and personal goals. Through tailored resources, academic and career support, and community connections, we aim to enhance the success and well-being of service members, veterans, and their loved ones as they transition into and thrive within higher education here on campus.

Class schedule

January (5 lectures)

S	M	T	W	T	F	S
		14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

February (12 lectures)

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	

Homework #1 is due in class on Wednesday

Homework #2 is due in class on Wednesday

Exam #1

Homework #3 is due in class on Wednesday

March (9 lectures)

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Homework #4 is due in class on Wednesday

Homework #5 is due in class on Wednesday

Exam #2

April (13 lectures)

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

Homework #6 is due in class on Wednesday

Homework #7 is due in class on Wednesday

Homework #8 is due in class on Wednesday

Exam #3

Homework #9 is due in class on Wednesday

May (4 lectures)

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14			

Homework #10 is due in class on Wednesday

Final Exam (7:30 am – 9:30 am)

We may deviate from this schedule. Exam and homework material will be adjusted accordingly.