Syllabus*: Solid State Physics (1901021471)

Second Semester 2021 /2022

COURSE INFORMATION	
Course Name: Solid State Physics **Semester:** **Department:** Department of Physics **Faculty:** Science	**Course Code: 1901012471** **Section:** 1 **Core Curriculum**:
Day(s) and Time(s): Sundays: 13:00-14:00 Tuesdays: 13:00-14:00 Thursdays: Online lecture (Activities) **Classroom:** **Al-**Husein Al-Baney C109	**Credit Hours:** 3 **Prerequisites**: **110102364**

COURSE DESCRIPTION

Crystal lattice: Bravais lattice. Structure of solids: Crystal structure. Elastic scattering of waves. Crystal bonding: Van der Waals bonding. Lattice vibrations and phonons. Thermal properties of crystalline solids. Free electron model; nearly free electron model, band theory and Fermi surfaces.

DELIVERY METHODS

The course will be delivered through a combination of active learning strategies. These will include:

- PowerPoint lectures and active classroom based discussion
- Collaborative learning through small groups acting in an interdisciplinary context. This part will be carried out within the context of hybrid course
- E-learning resources: e-reading assignments and practice quizzes through Moodle and Microsoft Team

FACULTY INFORMATION

Name	
Academic Title:	**Professor**
Office Location:	**Physics Building; Room # 204**
Telephone Number:	**Extn: 4203**
Email Address:	**rbadran@hu.edu.jo**
Office Hours:	**Sundays** 12.00-13.00 **Tuesdays** 12.00-13.00 **Thursdays** 14.00:15.00 Via MS Teams *Please send an e-mail (rbadran@hu.edu.jo) to meet at any other time.*

REFERENCES AND LEARNING RESOURCES

Required Textbook: *Introduction to Solid State Physics, 8th Edition*

Author: *Kittel C.*

Publisher: (John Wiley: 2005) ISBN: 0-471-41526-X

Suggested Additional Resources:

Omar M. A., " Elementary Solid State Physics: Principles and Applications" (Addison-Wesley, 1992).

Christman J. R.," Fundamentals of Solid State Physics" (John Wiley, 1988).

Hook J. R. and Hall H. E. " Solid State Physics" (John Wiley, 1991).

Rudden M. N. and Wilson J. "Elements of Solid State Physics"(John Wiley, 1993).

Rosenberg H. M. " *The Solid State".* (Oxford University Press 1997).

Useful Web Resources:

http://wug.physics.uiuc.edu/courses/phys389/fall02/
http://www.phy.ilstu.edu/Courses/355.html
http://solidstate.physics.sunysb.edu/teach/intlearn/
http://cst-www.nrl.navy.mil/lattice/
http://www.physics-network.org/PhysNet/education.html
http://buckminster.physics.sunysb.edu/intlearn/lattice/lattice.html

STUDENT LEARNING OUTCOMES MATRIX*

Core Curriculum Learning Outcomes	Program Learning Outcomes	Course Objectives	Course Student Learning Outcomes	Assessment Method
	.	1. Develop a transparent understanding of elementary solid state physics to enable students gaining a firm foundation for further study.	1. Know the basic crystal structure and describe different types of crystal structures in terms of the crystal lattice and the basis of constituent atoms. Understand spatial symmetries of different Bravais lattice structures.	➢ Exams ➢ Quizzes ➢ "On-line' Presentation assignments ➢ Study group assignments
		2. Provide strong links between solid state phenomena and the other basic laws of physics.	2. Understand the concept of reciprocal space and how to use it as a tool. Know the significance of Brillouin zones and their use to describe and analyze the electron energy in the band energy structure of crystals	➢ Exams ➢ Quizzes ➢ "On-line' presentation assignments ➢ Study group assignments
		3. Demonstrate the experimental roots of solid state theory and explain how fundamental quantities can be measured in some important experiments.	3. Recognize that the developed k-space formalism to describe phonons, electrons, is more general and can be used to describe waves in a periodic media and identify such 'out-of-the-course' physical situations/problems.	➢ Exams ➢ Quizzes ➢ "On-line' presentation assignments ➢ Study group assignments
		4. Explore the physical realization of much fundamental physics by shedding light on some technological applications.	4. Describe the different physical mechanisms involved in crystal binding identifying the repulsive and attractive interactions and correlate these with the atomic properties	➢ Exams ➢ Quizzes ➢ "On-line' presentation assignments ➢ Study group ➢ assignments
		5. Develop skills in solving problems in relevant to solid state	5. Explain crystal vibrations and the concept of phonon in solids. Perform estimates of phonons dispersive properties. Formulate the theory of	➢ "On-line" presentation assignments

		model and laws using analytical approaches	lattice vibrations (phonons) and use that to determine thermal properties of solids.	➢ Study group assignments
		6. Acquire progressive theme of improvement to model the physical properties of solids and at each stage explain why they are necessary, what added knowledge is obtained and what draw-backs still remain	6. Calculate thermal and electrical properties in the free-electron model.	➢ Study group assignments
			7. Formulate the problem of electrons in a periodic potential, examine its consequence on the band-structure of the solid and develop a framework that explains the physical properties of solids in terms of its band-structure.	➢ Exams ➢ Quizzes ➢ Study group assignments
			8. Know the principles of structure determination by diffraction. Account for how crystalline materials are studied using diffraction, including concepts like form factor, structure factor, and scattering amplitude.	➢ Exams ➢ Quizzes ➢ "On-line' presentation assignments

ACADEMIC SUPPORT

It is The Hashemite University policy to provide educational opportunities that ensure fair, appropriate and reasonable accommodation to students who have disabilities that may affect their ability to participate in course activities or meet course requirements. Students with disabilities are encouraged to contact their Instructor to ensure that their individual needs are met. The University through its Special Need section will exert all efforts to accommodate for individual's needs.

Special Needs Section:
Tel:
Location:
Email:

COURSE REGULATIONS

Participation

Class participation and attendance are important elements of every student's learning experience at The Hashemite University, and the student is expected to attend all classes. A student should not miss more than 15% of the classes during a semester. *Those exceeding this*

limit of 15% will receive a failing grade regardless of their performance. It is a student's responsibility to monitor the frequency of their own absences. **Attendance record begins on the first day of class irrespective of the period allotted to drop/add and late registration. It is a student's responsibility to sign-in; failure to do so will result in a non-attendance being recorded.**

In exceptional cases, the student, with the instructor's prior permission, could be exempted from attending a class provided that the number of such occasions does not exceed the limit allowed by the University. The instructor will determine the acceptability of an absence for being absent. A student who misses more than 25% of classes and has a valid excuse for being absent will be allowed to withdraw from the course.

Plagiarism

Plagiarism is considered a serious academic offence and can result in your work losing marks or being failed. HU expects its students to adopt and abide by the highest standards of conduct in their interaction with their professors, peers, and the wider University community. As such, a student is expected not to engage in behaviours that compromise his/her own integrity as well as that of the Hashemite University.

Plagiarism includes the following examples and it applies to all student assignments or submitted work:

- **Use of the work, ideas, images or words of someone else without his/her permission or reference to them.**
- **Use of someone else's wording, name, phrase, sentence, paragraph or essay without using quotation marks.**
- **Misrepresentation of the sources that were used.**

The instructor has the right to fail the coursework or deduct marks where plagiarism is detected

Late or Missed Assignments

In all cases of assessment, students who fails to attend an exam, class project or deliver a presentation on the scheduled date without prior permission, and/or are unable to provide a medical note, will automatically receive a fail grade for this part of the assessment.

- Submitting a term paper on time is a key part of the assessment process. Students who fail to submit their work by the deadline specified will automatically receive a 10% penalty. Assignments handed in more than 24 hours late will receive a further 10% penalty. Each subsequent 24 hours will result in a further 10% penalty.
- In cases where a student misses an assessment on account of a medical reason or with prior permission; in line with University regulations an incomplete grade for the specific assessment will be awarded and an alternative assessment or extension can be arranged.

Student Complaints Policy

Students at The Hashemite University have the right to pursue complaints related to faculty, staff, and other students. The nature of the complaints may be either academic or non-academic. For more information about the policy and processes related to this policy, you may refer to the students' handbook.

COURSE ASSESSMENT

Course Calendar and Assessment

Students will be graded through the following means of assessment and their final grade will be calculated from the forms of assessment as listed below with their grade weighting taken into account. The criteria for grading are listed at the end of the syllabus

Assessment	Grade Weighting	Deadline Assessment
Midterm Exam	30%	12/5/2022/13.00-14:00
Activities Include a) power point presentation b) Study Group Discussions		
Power point presentation	20%	29/3-26/5/2022/13.00-14:00
Study-Group Assessment	10%	29/3-26/5/2022/13.00-14:00

	Student	Presentation No.	Date	Time*	Total Mark
1.	Tasneem	9	29/3/2022	13:00-13:18	
2.	Alreem	10	29/3/2022	13:20-13:38	
3.	Nesreen	11	29/3/2022	13:40-13:58	
4.	Malak	5	7/4/2022	Ramadan time*	
5.	Haya	6	14/4/2022	Ramadan time*	

6.	Ameeneh	8	21/4/2022	Ramadan time*	
7.	Abdelrahman	7	21/4/2022	Ramadan time*	
8.	Ibrahim	2	28/4/2022	Ramadan time*	
9.	Hedaya	3	28/4/2022	Ramadan time*	
10.	Fares	13	19/5/2022	Ramadan time*	
11.	Nour	14	19/5/2022	Ramadan time*	
12.	Shefa	4	26/5/2022	Ramadan time*	
13.	Tamara	1	26/5/2022	Ramadan time*	
14.	Wejdan	12	26/5/2022	Ramadan time*	

*Order of time of presentation will be same as first three presenter-times but due to Ramadan timing

Description of Exams

Test questions will predominately come from material presented in the lectures. Semester exams will be conducted during the regularly scheduled lecture period. Exam will consist of a combination of multiple choice, short answer, match, true and false and/or descriptive questions.
Homework: Will be given for each chapter, while the chapter in progress you are supposed to work on them continuously and submit in next lecture when I finish the chapter.
You are also expected to work on in-chapter examples, self-tests and representative number of end of chapter problems. The answers of self-tests and end of chapter exercises are given at the end of the book.

Quizzes: Unannounced quizzes will be given during or/and at the end of each chapter based upon the previous lectures. It will enforce that you come prepared to the class.

No make-up exams, homework or quizzes will be given. Only documented absences will be considered as per HU guidelines.
Grades are not negotiable and are awarded according to the following criteria*:

Letter Grade	Description	Grade Points
A+	Excellent	4.00
A		3.75
A-		3.50
B+	Very Good	3.25
B		3.00

B-		2.75
C+	Good	2.50
C		2.25
C-		2.00
D+	Pass	1.75
D	Pass	1.50
F	Fail	0.00
I	Incomplete	-

WEEKLY LECTURE SCHEDULE AND CONTENT DISTRIBUTION

Note: For SSP 471 sections with 2 lecture periods per week (S/T, M/W or T/R), one lecture period covers 1.5 lecture hours (80 minutes).

Topics	No. of Weeks	Contact Hours*
Crystal Structure	2	6
Reciprocal Lattice	3	9
Crystal Binding	3	9
Crystal Vibrations	3	9
Thermal Properties	2	6
Free Electron Fermi Gas	1	3
Energy Bands	1	3
Total	**15**	**45**

*Contact Hours include lectures, quizzes, student's activities and exams.

ASSESSMENT RUBRICS

Classroom Participation: Assessment Criteria

Classroom Participation: Oral Presentation										
Element	**Excellent**			**Satisfactory**			**Needs Improvement**			**Points**
	8	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
Organization	➢ There is a logical sequence of information. ➢ Title slide and closing slide are included appropriately.			➢ There is some logical sequence of information. ➢ Title slide and closing slides are included.			➢ There is little or no logical sequence of information. ➢ Title slide and/ or closing slides are not included.			
Slide Design (text, colors, background, illustrations, size, titles, subtitles) and creativity in using Demos	➢ Presentation is attractive and appealing to viewers. ➢ Used demos are excellent			➢ Presentation is somewhat appealing to viewers. ➢ Used demos are good			➢ Little to no attempt has been made to make presentation appealing to viewers. ➢ No substantive use of demos			
Content and quality of references	➢ Presentation covers topic completely and in depth. ➢ Information is clear, appropriate, and accurate. ➢ Outstanding References are used			➢ Presentation includes some essential information. ➢ Some information is somewhat confusing, incorrect, or flawed. ➢ Good References are used			➢ Presentation includes little essential information. ➢ Information is confusing, inaccurate, or flawed. ➢ References are not encouraging and useful			
Language	➢ Spelling, grammar, usage, and punctuation are accurate ➢ Fluent and effective			➢ There are minor problems in spelling, grammar, usage, and/or punctuation.			➢ There are persistent errors in spelling, grammar, usage, and/or punctuation. ➢ Less or not fluent and effective.			
Delivery	➢ Ideas were communicated with enthusiasm, proper voice projection and clear delivery. ➢ There was sufficient eye contact with audience. ➢ There were sufficient use of other non-verbal communication skills.			➢ There was some difficulty communicating ideas due to voice projection, lack of preparation, incomplete work, and/or insufficient eye contact. ➢ Insufficient use of non-verbal communication skills. ➢ Delivery pace is somewhat appropriate.			➢ There was great difficulty communicating ideas due to poor voice projection, lack of preparation, incomplete work, and/or little or no eye contact. ➢ No use of non verbal communication skills.			

	➢ Appropriate delivery pace was used.		➢ Inappropriate delivery pace was used.	
Interaction with Audience (Answering questions)	▪ Answers to questions are coherent and complete. ➢ Answers demonstrate confidence and extensive knowledge.	➢ Most answers to questions are coherent and complete. ➢ Answers somehow demonstrate confidence and extensive knowledge.	➢ Answers to questions are neither coherent nor complete. ➢ Is tentative or unclear in responses.	
	Total Score (Y x 5/16) =			