مركز الاعتماد وضمان الجودة

# Course Syllabus

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|---|---|---|---|
| 1 | **Course title** | Solid State Physics | |
| 2 | **Course number** | 0302471 | |
| 3 | **Credit hours** | 3 | |
| | **Contact hours (theory, practical)** | 3 | |
| 4 | **Prerequisites/corequisites** | Quantum Mechanics (0332361) | |
| 5 | **Program title** | Physics | |
| 6 | **Program code** | 2 | |
| 7 | **Awarding institution** | The University of Jordan | |
| 8 | **School** | Science | |
| 9 | **Department** | Physics | |
| 10 | **Course level** | Senior (fourth year) | |
| 11 | **Year of study and semester(s)** | First semester, 2023-2024 | |
| 12 | **Other department(s) involved in teaching the course** | None | |
| 13 | **Main teaching language** | English | |
| 14 | **Delivery method** | ☒Face to face learning ☐Blended ☐Fully online | |
| 15 | **Online platforms(s)** | ☐Moodle ☒Microsoft Teams ☐Skype ☐Zoom ☐Others…… | |
| 16 | **Issuing/Revision Date** | 9/10/2023 | |

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**17 Course Coordinator:**

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| Name: Riad Shaltaf | Contact hours: 11:30 – 13:00 Mon, Wed. Office number: 115 |
| Phone number: 22067 | |
| Email: r.shaltaf@ju.edu.jo | |

**18 Other instructors:**

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| None |

**19 Course Description:**

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| Crystal lattice and structure; reciprocal lattice; crystal binding; lattice vibrations; elastic scattering of waves; thermal properties of solids; free-electron gas, energy bands in solids. |

20 **Course aims and outcomes:**

## Physics of Materials-0332371

B- Students Learning Outcomes (SLOs):

For purposes of mapping the course SLOs to the physics program SLOs, at the successful completion of the physics program, graduates are expected to be able to:

**SLO (1)** Master professionally a broad set of knowledge concerning the fundamentals in the basic areas of physics: Classical Mechanics, Electrostatics and Magnetism, Quantum Mechanics, Thermal Physics, Optics, Theory of Special Relativity, Mathematical Physics, Electronics.

**SLO (2)** Apply knowledge of mathematics and fundamental concepts in the basic areas of physics to identify and solve physics related problems.

**SLO (3)** Utilize computers and available software in both data collections and data analysis.

**SLO (4)** Utilize standard laboratory equipment, modern instrumentation, and classical techniques to design and conduct experiments as well as to analyze and interpret data.

**SLO (5)** Develop a recognition of the need and ability to engage in life-long learning.

**SLO (6)** Demonstrate ability to use techniques, skills, and modern scientific tools necessary for professional practice.

**SLO (7)** Communicate clearly and effectively in both written and oral forms.

**SLO (8)** Apply proficiently team-work skills and employ team-based learning strategies.

**SLO (9)** Apply professional and ethical responsibility to society.

Upon successful completion of this course, students will be able to:

| Program SLOs / Course SLOs | SLO (1) | SLO (2) | SLO (3) | SLO (4) | SLO (5) | SLO (6) | SLO (7) | SLO (8) | SLO (9) |
|---|---|---|---|---|---|---|---|---|---|
| 1. Grasping the fundamentals of atomic arrangements, including crystal structures and defects, to comprehend material properties at the atomic level. | ✓ | ✓ | | | | | | | |
| 2. Grasp of fundamental material properties like mechanical, electrical, thermal, and optical properties, and the factors influencing these properties. | ✓ | ✓ | | | | | | | |
| 3. Developing knowledge about how materials deform, fracture, and behave under stress, covering | ✓ | ✓ | | | | | | | |

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| concepts like elasticity, plasticity, and toughness. | | | | | | | | | |
| 4. Understanding heat transfer mechanisms in materials and their response to changes in temperature, including thermal conductivity and expansion. | ✓ | ✓ | | | | | | | |
| 5. Familiarization with various experimental methods used to analyze and characterize materials, such as spectroscopy, microscopy, and diffraction. | | ✓ | | | | | | | |
| 6. Development of problem-solving skills through the application of principles learned to analyze and solve material-related issues or scenarios. | ✓ | ✓ | | | | | | | |

## 21. Topic Outline and Schedule:

| Week | Lecture | Topic | Intended Learning Outcome | Learning Methods (Face to Face/Blended/ Fully Online) | Platform | Synchronous / Asynchrono us Lecturing | Evaluation Methods | Resources |
|---|---|---|---|---|---|---|---|---|
| 1 9/10 | 1.1 | Crystal structure | SLO(1), | Face to face | | | Test | For all units of this course, the students may refer to the following resources:<br><br>*Text book and suggested references<br><br>*Classroom lectures |
| | 1.2 | Crystal structure | SLO(1), | Face to face | | | Test | |
| 2 16/10 | 2.1 | Crystal structure | SLO(1), | Face to face | | | Test | |
| | 2.2 | Crystal Structure | SLO(1), | Face to face | | | Test | |
| 3 23/10 | 3.1 | Crystal Structure | SLO(1), | Face to face | | | Test | |
| | 3.2 | Reciprocal Lattice | SLO(1), SLO(5) | Face to face | | | Test | |
| 4 30/10 | 4.1 | Reciprocal lattice | SLO(1), SLO(5) | Face to face | | | Test | |

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|---|---|---|---|---|---|---|---|---|
| | 4.2 | Reciprocal lattice | SLO(1), SLO(5) | Face to face | | | Test | |
| 5 6/11 | 5.1 | Reciprocal Lattice | SLO(1), SLO(5) | Face to face | | | Test | |
| | 5.2 | Reciprocal lattice | SLO(1), SLO(5) | Face to face | | | Test | |
| 6 13/11 | 6.1 | Crystal binding | SLO(3), | Face to face | | | Test | |
| | 6.2 | Crystal binding | SLO(3), | Face to face | | | Test | |
| 7 20/11 | 7.1 | Crystal binding | SLO(3), | Face to face | | | Test | |
| | 7.2 | Crystal binding | SLO(3), | Face to face | | | Test | |
| | | | | | | | | |
| 8 27/11 | 8.1 | 28/11/2022, First Exam | | | | | | |
| | 8.2 | Phonon modes | SLO(2), SLO(3) | Face to face | | | Test | |
| 9 4/12 | 9.1 | Phonon modes | SLO(2), SLO(3) | Face to face | | | Test | |
| | 9.2 | Phonon modes | SLO(2), SLO(3) | Face to face | | | Test | |
| 10 11/12 | 10.1 | Thermal properties | SLO(4), | Face to face | | | Test | |
| | 10.2 | Thermal properties | SLO(4), | Face to face | | | Test | |
| 11 18/12 | 11.1 | Thermal properties | SLO(4), | Face to face | | | Test | |
| | 11.2 | Thermal properties | SLO(4), | Face to face | | | Test | |

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|---|---|---|---|---|---|---|---|---|
| 12<br>25/12 | 12.1 | 26/12/2022, Second Exam | | | | | | |
| | 12.2 | Free electron gas | SLO(2), | Face to face | | | Test | |
| 13<br>1/1 | 13.1 | Free electron gas | SLO(2), | Face to face | | | Test | |
| | 13.2 | Free electron gas | SLO(2), | Face to face | | | Test | |
| 14<br>8/1 | 14.1 | Free electron gas | SLO(2), | Face to face | | | Test | |
| | 14.2 | Energy bands | SLO(2), | Face to face | | | Test | |
| 15<br>15/1 | 15.1 | Energy bands | SLO(2), | Face to face | | | Test | |
| | Tuesday, 17/01/2023 is the last day of teaching. 19/01/2023 – 30/01/2023 is the period of final exams | | | | | | | |

**22 Evaluation Methods:**

Opportunities to demonstrate achievement of the SLOs are provided through the following assessment methods and requirements:

| Evaluation Activity | Mark | Topic(s) | SLOs | Period (Week) | Platform |
|---|---|---|---|---|---|
| First Exam | 20 | Crystal structure & Reciprocal lattice | SLO(1) , SLO(5) | Week 8<br>(28/11/2022) | |
| Second Exam | 30 | Crystal binding & Phonon modes | SLO(2) – SLO(4) | Week 12<br>(26/12/2022) | |

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|---|---|---|---|---|---|
| Final Exam | 50 | All course content | SLO(1) – SLO(5) | | |

**23 Course Requirements**

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| **Each student should have access to a computer & internet connection** |

**24 Course Policies:**

A- Attendance policies:

Attendance is mandatory. Students who record absences more than the legally acceptable limit **may lose their chance to sit for the final exam of the course**.

B- Absences from exams and submitting assignments on time:

False medical reports and other devious ways to avoid taking exams on time are not acceptable. The students are encouraged to handle their responsibility and develop **positive learning attitudes**.

C- Health and safety procedures:

Follow the instructions regarding health and safety procedures in the university.

D- Honesty policy regarding cheating, plagiarism, misbehavior:

The course is designed to provide students with learning opportunities. Group work and discussions accompanied with individual input and hard work are encouraged to fulfill the objectives of the course, whereas **cheating and misbehavior are completely unacceptable**.

E- Grading policy:

Do not waste time arguing about grades and grading policies. Instead, invest your time in fruitful learning.

F- Available university services that support achievement in the course:

- E-learning resources
- Microsoft Teams
- Smart Class rooms
- Computer facilities

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## 25 References:

A- Required book(s), assigned reading and audio-visuals:

*Textbook: Charles Kittel; Introduction to Solid State Physics, 8th Ed., (John Wiley & Sons, Hoboken, NJ, 2005) Power point presentations and illustrations designed to explain the contents of the course.

B- Recommended books, materials, and media:

[1] J.S. Blakemore, Solid State Physics, 2nd Ed., (Cambridge University Press, Cambridge, 1985)
[2] M.S. Rogalski and S.B. Palmer, Solid State Physics, (Gordon and Breach Science Publishers, Australia, 2000)
[3] J. Richard Christman, Fundamentals of Solid State Physics, John Wiley & Sons, New York, 1988)

## 26 Additional information:

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|---|---|---|
| Name of Course Coordinator: Riad Shaltaf | Signature | Date: 9/10/2024 |
| Head of Curriculum Committee/Department: ---------- | | Signature: ---------- |
| Head of Department: ---------- | | Signature: ---------- |
| Head of Curriculum Committee/Faculty: ---------- | | Signature: ---------- |
| Dean: ---------- | | Signature: ---------- |