مركز الاعتماد وضمان الجودة
ACCREDITATION & QUALITY ASSURANCE CENTER

Course Syllabus

1	**Course title**	Physics of Materials	
2	**Course number**	0332371	
3	**Credit hours**	3	
	Contact hours (theory, practical)	3,0	
4	**Prerequisites/corequisites**	0302261	
5	**Program title**	B.Sc.	
6	**Program code**		
7	**Awarding institution**	University of Jordan	
8	**School**	Science	
9	**Department**	Physics	
10	**Course level**	Bachelor	
11	**Year of study and semester(s)**	2023-2024, First Semester	
12	**Other department(s) involved in teaching the course**		
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**	Oct 8, 2023	

17 Course Coordinator:

Name: Ahmad S Masadeh	Contact hours: Sunday Monday 11 -12
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18 Other instructors:

Name:
Office number:
Phone number:
Email:

19 Course Description:

Atomic structure and interatomic bonding; crystalline solids; imperfections in solids; diffusion; mechanical properties of metals; dislocations and strengthening mechanisms; phase diagrams; phase transformations in metals; structure and properties of ceramics; polymer structures; composites

20 Course aims and outcomes:


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A- Aims:

The aim of a physics of materials course at the undergraduate level is to introduce students to the fundamental principles governing the behavior, properties, and applications of materials from a physics perspective. This course typically covers the structure of materials at atomic and molecular levels, the relationship between structure and properties, and how materials respond to various external conditions like temperature, pressure, and electromagnetic fields.

Key objectives of such a course may include:

1. **Understanding Structure-Property Relationships:** Teaching students how the atomic and molecular structure of materials influences their mechanical, electrical, magnetic, and thermal properties.
2. **Material Characterization Techniques:** Introducing students to various experimental techniques used to study materials, such as X-ray diffraction, electron microscopy, spectroscopy, and other analytical methods.
3. **Mechanical Behavior of Materials:** Explaining the mechanical properties of materials including elasticity, strength, toughness, and how these properties relate to the material's structure.
4. **Electronic Properties:** Covering topics like conductivity, semiconductors, and how the arrangement of atoms affects electrical properties.
5. **Applications and Material Selection:** Discussing real-world applications of different materials in various industries and helping students understand the selection criteria for specific materials in different contexts.
6. **Nanomaterials and Advanced Materials:** Providing an introduction to emerging materials, such as nanomaterials, polymers, composites, and their unique properties.

Overall, the course aims to equip students with a foundational understanding of the physical principles underlying materials, enabling them to comprehend and contribute to advancements in material science and engineering.

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:

1. An ability to identify, formulate, and solve broadly defined technical or scientific problems by applying knowledge of mathematics and science and/or technical topics to areas relevant to the discipline.
2. An ability to formulate or design a system, process, procedure or program to meet desired needs.
3. An ability to develop and conduct experiments or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions.
4. An ability to communicate effectively with a range of audiences.
5. An ability to understand ethical and professional responsibilities and the impact of technical and/or scientific solutions in global, economic, environmental, and societal contexts.

6. An ability to function effectively in teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

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

Course SLOs \ Program 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 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	Topic	Intended Learning Outcome	Learning Methods (Face to Face/Blended/ Fully Online)	Platform	Synchronous / Asynchronous Lecturing	Evaluation Methods	Resources
1	Atomic Structure and Interatomic bonding Mixed Bonding And Bonding Type-Material	ILO(2)	Blended	Teams	Synchronous and Asynchronous Lecturing		
2	Fundamental Concepts 3.3: Unit Cell 3.4: Crystal Systems Point Coordinates	ILO(2)	Blended	Teams	Synchronous and Asynchronous Lecturing		
3	Crystallographic Directions Crystallographic Planes	ILO(2)	Blended	Teams	Synchronous and Asynchronous Lecturing		

4	Single Crystal Polycrystalline Materials Noncrystalline Solids	ILO(1,3)	Blended	Teams	Synchronous and Asynchronous Lecturing		
5	4.2: The Face-Centered Cubic (FCC) ... 4.3: The Body-Centered Cubic (BCC)… 4.4: The Hexagonal Closed-Packed (HCP)… 4.5: Density Computing-Metals	ILO(1,3)	Blended	Teams	Synchronous and Asynchronous Lecturing		
6	4.6: Ionic Arrangement Geometries 4.7: AX-Type Crystal Structures 4.10: Density Computing-Ceramic 4.12: Carbon (diamond vs. graphite)	ILO(1,3)	Blended	Teams	Synchronous and Asynchronous Lecturing		
7	4.13: Polymer Crystallinity 4.15: Atomic Arrangements 4.16: Linear and Planar Densities 4.17: Closed-Packed Crystal Structures	ILO(3)		Teams	Synchronous and Asynchronous Lecturing		

8	4.18: The Diffraction Phenomena 4.19: X-Ray Diffraction and Bragg's Law	ILO(3)	Blended	Teams	Synchronous and Asynchronous Lecturing		
9	6.2: Point Defects in Metals 6.4: Impurities in Solids 6.6: Specification of Composition	ILO(3)	Blended	Teams	Synchronous and Asynchronous Lecturing		
10	7.1: Introduction 7.2: Diffusion Mechanisms 7.3: Steady-State Diffusion (Fick's first Law) 7.4: Non Steady-State Diffusion 7.5: Factors That Influence Diffusion	ILO(3,4)	Blended	Teams	Synchronous and Asynchronous Lecturing		
11	8.1 Introduction 8.2 Concepts of Stress and Strain 8.3 Stress–Strain Behavior 8.4 Anelasticity 8.5 Elastic Properties of Materials	ILO(1,3,4)	Blended	Teams	Synchronous and Asynchronous Lecturing		

12	8.6 Tensile Properties 180 8.7 True Stress and Strain 187 8.8 Elastic Recovery After Plastic 8.9 Compressive, Shear, and Torsional 8.10 Hardness	ILO(5)	Blended	Teams	Synchronous and Asynchronous Lecturing		
13	19.1 Introduction 19.2 Heat Capacity 19.3 Thermal Expansion	ILO(5)	Blended	Teams	Synchronous and Asynchronous Lecturing		
14	19.4 Thermal Conductivity 19.5 Thermal Stresses Problems	ILO(5)	Blended	Teams	Synchronous and Asynchronous Lecturing		
15	Review	ILO(1-5)	Blended	Teams	Synchronous and Asynchronous Lecturing		

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 Midterm	30%	Atomic Structure and Interatomic bonding. Fundamental of Crystallography	ILO 1,2	6th	
2nd midterm	30%	The Structure of Crystalline Solid. Imperfection in Solids	ILO 3,4	11th	
Final exam	40%	All subjects	ILO 1-5	15th	

23 Course Requirements

(e.g: students should have a computer, internet connection, webcam, account on a specific software/platform…etc):

The students are expected to have internet connection and a calculator

24 Course Policies:

A-Attendance policies:

Students are expected to attend all class sessions. If a student cannot attend a class session, the teacher must be notified prior to that. For the university's rules and regulations, the student's

total absences must not exceed 15 % of the total class hours. Please refer to the University of Jordan student Handbook for further explanation.

B-Absences from exams and handing in assignments on time:

a. Failure in attending a course exam other than the final exam will result in zero mark unless the student provides an official acceptable excuse to the instructor who approves a make up exam.
b. Failure in attending the final exam will result in zero mark unless the student presents an official acceptable excuse to the Dean of his/her faculty who approves an incomplete exam, normally scheduled to be conducted during the first two weeks of the successive semester.

C-Health and safety procedures:

We don't have any policy at the moment considering the safety procedures, nevertheless, the instructor in each session has to give a general safety instructions for the student.

D-Honesty policy regarding cheating, plagiarism, misbehavior:

Cheating, plagiarism, misbehavior are attempts to gain marks dishonestly and includes; but not limited to:

- Copying from another student's work.
- Using materials not authorized by the institute.
- Collaborating with another student during a test, without permission.
- Knowingly using, buying, selling, or stealing the contents of a test.
- Plagiarism which means presenting another person's work or ideas as one's own, without attribution.
- Using any media (including mobiles) during the exam.

E- Grading policy:

Grades will be awarded based on the statistical distribution of marks out of 100%

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

- Faculty members website
- E-Learning website

25 References:

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

1. W. Callister and David G. Rethwisch “Materials Science and Engineering - SI Version” 9 th edition.

Recommended books, materials, and media:

2. Introduction to Materials Science for Engineers" by James F. Shackelford.
3. **Materials Science and Engineering: Properties" by Charles Gilmore**

26 Additional information:

Name of Course Coordinator: -Ahmad Msadeh----------Signature: ---------- Date: 10-10-2023---
Head of Curriculum Committee/Department: ---------- Signature: ----------
Head of Department: ---------- Signature: ----------
Head of Curriculum Committee/Faculty: ---------- Signature: ----------
Dean: ---------- Signature: ----------