مركز الاعتماد وضمان الجودة
ACCREDITATION & QUALITY ASSURANCE CENTER

Course Syllabus

1	**Course title**	Physics of Semiconductors
2	**Course number**	0302472
3	**Credit hours**	3
	Contact hours (theory, practical)	Theory 3
4	**Prerequisites/corequisites**	0302471 Solid State Physics
5	**Program title**	BSs
6	**Program code**	0302
7	**Awarding institution**	The University of Jordan
8	**School**	Science
9	**Department**	Physics
10	**Course level**	4th year level
11	**Year of study and semester(s)**	
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**	25-7-2024

17 Course Coordinator:

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18 Other instructors:

19 Course Description:

Semiconductor crystal structure; the energy band structure of crystals; transport of carriers in semiconductors; semiconductor diode devices and frequency speed behavior; and the bipolar junction transistor (BJT).

20 Course aims and outcomes:

A- Aims:

After successfully completing this course, the student will be able to:

1- Students need to establish a relation between semiconductors physics and all other fields of physics.

2- Students are expected to understand how the band theory come to existence by studying the kronig-Penny model for 1D crystals.

3- The students are expected to relate the concepts of electrons and holes to their effective masses and their density of states.

4- The students are expected to understand the concept of band gap energy and develop a proper understanding of semiconductors under equilibrium.

5- Students are expected to develop and understanding for carrier transport and the formation of pn-junctions.

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: Quantum Mechanics, Classical Mechanics, Electrostatics and Magnetism, 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:

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Program SLOs / Course SLOs	SLO (1)	SLO (2)	SLO (3)	SLO (4)	SLO (5)	SLO (6)	SLO (7)	SLO (8)	SLO (9)
1. Students need to establish a relation between semiconductors physics and all other fields of physics.		✓				✓			
2. Students are expected to understand how the band theory come to existence by studying the kronig-Penny model for 1D crystals.		✓				✓			
3. The students are expected to relate the concepts of electrons and holes to their effective masses and their density of states.		✓				✓			
4. The students are expected to understand the concept of band gap energy and develop a proper understanding of semiconductors under equilibrium.		✓				✓			
5. Students are expected to develop and understanding for carrier transport and the formation of pn-junctions.		✓				✓			
6. Students need to establish a relation between semiconductors physics and all other fields of physics.		✓				✓			

21. Topic Outline and Schedule:

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Week	Lecture	Topic	Intended Learning Outcome	Learning Methods (Face to Face/Blended/ Fully Online)	Platform	Synchronous / Asynchronous Lecturing	Evaluation Methods	Resources
1	1.1	**Ch1: The crystal structure of solids**	1	F to F	teams		Exams, In class exams and H.W sets	
	1.2							
	1.3							
2	2.1			F to F	teams		Exams, In class exams and H.W sets	
	2.2							
	2.3							
3	3.1							
	3.2							
	3.3	**Ch2: Introduction to Quantum Mechanics**						
4	4.1			F to F	teams		Exams, In class exams and H.W sets	
	4.2							
	4.3							
5	5.1	**Ch3: Introduction to Quantum Theory of Solids**	2	F to F	teams		Exams, In class exams and H.W sets	
	5.2							
	5.3							
6	6.1							
	6.2							
	6.3							
7	7.1			F to F	teams		Exams, In class exams	

	7.2						and H.W sets	
	7.3							
8	8.1	**Ch4: The Semiconductor in Equilibrium**	3	F to F	teams		Exams, In class exams and H.W sets	
	8.2			F to F	teams			
	8.3							
9	9.1							
	9.2							
	9.3							
10	10.1	**Ch5: Carrier Transport Phenomena**	4	F to F	teams		Exams, In class exams and H.W sets	
	10.2							
	10.3							
11	11.1							
	11.2							
	11.3							
12	12.1	**Ch7: The pn Junction**	5,6	F to F	teams		Exams, In class exams and H.W sets	
	12.2							
	12.3							
13	13.1							
	13.2							
	13.3							
14	14.1	**Ch8: The pn Junction Diode**	5,6	F to F	teams		Exams, In class exams and H.W sets	
	14.2							
	14.3							
15	15.1							
	15.2							

	15.3							

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
Midterm Exam	30	CH 1,2,3,4	1,2,3	6 weeks	Face to Face
In class exams and homework sets	30	CH 1,2,3,4,5,6,7,8	1,2,3,4,5,6	16 weeks	Face to Face
Final Exam	40	All	1,2,3,4,5,6	Last week	Face to Face

23 Course Requirements

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

Internet , computer.

24 Course Policies:

A- Attendance policies: Regular attendance at all learning activities is expected, and unsatisfactory attendance maylead to disciplinary action according to the University of Jordan regulations.

B- Absences from exams and submitting assignments on time: Students may be permitted to make up an exammissed due to illness or other legitimate absence. A doctor's certification before allowing a student to make up an exam due to illness is required.

C- Health and safety procedures:

D- Honesty policy regarding cheating, plagiarism, misbehavior: The University Of Jordan policy will be implemented

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E- Grading policy: according to the table above.

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

25 References:

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

Semiconductor Physics and Devices: Basic Principles", Third Edition, by Donald A. Neamen, 2003. (You may also use the 4th edition)

B- Recommended books, materials, and media:

1) "Basic Semiconductor Physics", Second Edition, by Chihiro Hamaguchi, 2010.
2) "Physics of Semiconductor Devices", Third Edition, by S. M. Sze and Kwok K. Ng, 2007.
3) "Physics of Semiconductor Devices", by J. P. Colinge and C. A. Colinge, 2002.

26 Additional information:

Honor system is followed in this course, so I expect all students to do their homework assignments by themselves and I don't expect anything other than scientific discussions between students taking this course. Students are also advised to look for other resources that may help them in understanding the material and homework assignments.

The evaluation of this course is based on an interactive learning experience through detailed in class discussion, in class exams, computer based graphics and calculations, class projects, and a final examination.

***All plotting questions must be done using "Mathematica" or any equivalent software. No hand plots will be accepted. Many other calculations can also be done using "Mathematica" or any other software. Students are advised to use all available software resources for homework assignments.

Name of Course Coordinator: Bashar LahlouhSignature: ---------- Date: ----------

Head of Curriculum Committee/Department: ---------- Signature: ----------

Head of Department: ---------- Signature: ----------
Head of Curriculum Committee/Faculty: ---------- Signature: ----------
Dean: ---------- Signature: ----------