هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Semiconductor Physics**
Course Code:	**PHY4703**
Program:	**Physics**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours: 4
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: 4th Year / Level 11
4. Pre-requisites for this course (if any): **Solid State Physics 1 + Co-requisite: Solid State Physics 2**
5. Co-requisites for this course (if any): **Solid state physics 2**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	30
2	Laboratory/Studio	30
3	Tutorial	-
4	Others (specify)	-
	Total	60

B. Course Objectives and Learning Outcomes

1. Course Description

This course offers the fundamentals knowledge on semiconductor physics, it covers the introductory quantum theory of solids and then moves on to the semiconductor material physics, considers the physics of the semiconductor in thermal equilibrium, treats the transport phenomena of the charge carriers in a semiconductor, and the nonequilibrium excess carrier characteristics and treats the electrostatics of the basic pn junction.

2. Course Main Objective

1-Understanding the fundamentals of the theory of semiconductor physics
2-This course help students to understand the physics of the semiconductor in equilibrium and non equilibrium state and carrier transport phenomena.
3- The course offers an understanding the basic phenomena in semiconductor devices as pn junction.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Define the nature and state of semiconductor materials	K1(I)
1.2	Describe the electrical mechanism in semiconductor materials.	K2(I)
2	**Skills :**	
2.1	Solve the problems using electrical theory of solid state	S1(I)
2.2	Analyze the transport phenomena in semiconductor device	S2(I)
3	**Values:**	
3.1	working and contribute responsibly and effectively in group	V2(P)

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction to the Quantum Theory of Solids** • Allowed and Forbidden Energy Bands • Electrical Conduction in Solids • Extension to Three Dimensions • Density of States Function • Statistical Mechanics	**6**
2	**The Semiconductor in Equilibrium** • Charge Carriers in Semiconductors • Dopant Atoms and Energy Levels • The Extrinsic Semiconductor • Statistics of Donors and Acceptors • Charge Neutrality • Position of Fermi Energy Level	**8**
3	**Carrier Transport Phenomena** • Carrier Drift • Carrier Diffusion • Graded Impurity Distribution • The Hall Effect	**8**
4	**The pn Junction** • Basic Structure of the pn Junction • Zero Applied Bias • Reverse Applied Bias • Junction Breakdown • Nonuniformly Doped Junctions • Ideal current-voltage relationship for pn junction	**8**
5	**Practical Part:** • Students will conduct various experiments in the practical part of the course. Each student will perform the experiment, collect data, extract result, and prepare a written report every week.	**10**
	Total	**40**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	Define the nature and state of semiconductor materials	1- Describe the basic principles through lectures. 2. Discussing phenomena of different examples with illustrating pictures and diagrams 3. Using Board, Power point	a) Home work b) Exams c) Discussions and Quizzes
1.2	Describe the electrical mechanisms in semiconductor materials.		
2.0	**Skills**		
2.1	Solve the problems using electrical theory of solid state	Discussing phenomena of different examples with illustrating pictures and diagrams 2. clarify the steps to solve a problem 3. Using Board, Power point	a) Home work c) exams d) Discussions and Quizzes
2.2	Present the transport phenomena in semiconductor device		
3.0	**Values**		
3.1	working and contribute responsibly and effectively in group	1.Small group discussion. 2. encourage students to prepare research reports in groups	a. Evaluate the efforts of each student in preparing the report. b. Evaluation of students presentations

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quizzes & Home works	Every week	5%
2	Exercises, Participation, In-Class Problem Solving	Every week	5%
3	Midterm Exams	6^{th} ,10^{th} week	20%
4	Lab. Reports and Exam	Every week	20%

#	Assessment task*	Week Due	Percentage of Total Assessment Score
5	Final exam	12th week	50%
6			
7			
8			

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :
Each student will be supervised by academic adviser in physics Department and academic support time table is given to the student. (O.H. 3hrs a week)

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	**Semiconductor Physics and Devices** *Basic Principles,* **Fourth Edition** **Donald A. Neamen,** *University of New Mexico*
Essential References Materials	1. Introduction to Solid State Physics. C. Kittel / 8th edition (2005). 2. Solid State Physics, by R. K. Puri & V. K. Babbar 3rd Edition (2008).
Electronic Materials	
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Lecture room for 30 students Laboratory for Semiconductors there is a special course for laboratory related to Semiconductors
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Library

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Questionaries	teachers	Open discussion in the class room at the end of the lectures

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	