هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Physics of Semiconductors**
Course Code:	**2034222-3**
Program:	**Bachelor in Physics**
Department:	**Physics Department**
College:	**College of Science**
Institution:	**Taif University**

Table of Contents

A. Course Identification

1. Credit hours: 3
2. Course type **a.** University ☐ College ☑ Department ☐ Others ☐ **b.** Required ☐ Elective ☑
3. Level/year at which this course is offered: 12th Level/ 4th Year
4. Pre-requisites for this course (if any)**: None**
5. Co-requisites for this course (if any)**: None**

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	40
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (specify)	0
	Total	**40**

B. Course Objectives and Learning Outcomes

1. Course Description

Introduction to semiconductor materials, Elemental and compound semiconductors, Intrinsic and extrinsic semiconductors, Electronic properties of semiconductors, Carrier transport phenomena, Optical processes in semiconductors, Theory of p-n junctions, Ideal current-voltage characteristics, Metal-Semiconductor contact, Schottky barriers and Ohmic contacts, Semiconductor heterojunctions.

2. Course Main Objective

- Review the basic concepts of semiconductors.
- Learn the properties of semiconductors.
- Derive the basic equations of carrier concentrations and currents.
- Learn the basic concepts of semiconductor devices.
- Obtain the knowledge of new trends in semiconductor materials.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Recognize the basic concepts of semiconductors.	K1
1.2	Outline the methods of solid state physics to study the semiconductor phenomena and their applications.	K3
2	**Skills :**	
2.1	Explain the daily life applications of the studied topics.	S1
2.2	Develop skill versatility in solving problems related to semiconductor physics.	S2
3	**Values:**	
3.1	Show responsibility for working independently and for continuous improvement of personal capacities.	V1

C. Course Content

No	List of Topics	Contact Hours
1	Unit 1: Characteristics of semiconductor materials. Crystal structures of semiconductors	**7**
2	Unit 2: Theory of bands and semiconductors. Energy gap in semiconductors. Measurement of energy gap.	**7**
3	Unit 3: Dynamics of electrons in semiconductor conduction band. Holes and hole properties. Density of carriers in semiconductors. Fermi level in semiconductors, Optical processes in semiconductors	**8**
4	Unit 4: Effects of dopants in semiconductors. p- and n-types of doping, Charge balance and movement. Ionization of donors and acceptors.	**7**
5	Unit 5: Theory of p-n junctions, Ideal current-voltage characteristics, Metal-Semiconductor contact, Schottky barriers and Ohmic contacts, Semiconductor heterojunctions	**8**
6	Revision	**3**
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	Recognize the basic concepts of semiconductors.	Lectures	Recognize the basic concepts of semiconductors.
1.2	Outline the methods of solid state physics to solve the semiconductor phenomena and their applications.	Lectures Discussions	-Assignments -Written exams
2.0	**Skills**		
2.1	Explain the daily life applications of the studied topics.	Lectures Discussions	-Assignments -Written exams

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	Develop skill versatility in solving problems related to semiconductor physics	Problem solving	-Assignments -Written exams
3.0	**Values**		
3.1	Show responsibility for working independently and for continuous improvement of personal capacities.	Class participation and Essays	-Essays and activities evaluation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Activities	Periodically	10%
2	Midterm exam	6^{th}	30%
3	Short exam	9^{th}	10%
4	Final exam	12^{th}	50%

***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 faculty member is assigned a group of students for continuous academic advice during six office hours weekly (6 hrs./week).
- Teaching staff are available for individual student consultations during office hours.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• S. M., SZE, Semiconductor Devices: Physics and Technology, AT& T Bell Laboratories, Murray Hill, New Jersey, John Wiley & Sons, 1985. • R. A. Smith, Semiconductors, 2nd edition, Cambridge University Press, 1986.
Essential References Materials	• S. M., SZE, Semiconductor Devices: Physics and Technology, AT& T Bell Laboratories, Murray Hill, New Jersey, John Wiley & Sons, 1985. • R. A. Smith, Semiconductors, 2nd edition, Cambridge University Press, 1986.
Electronic Materials	http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html https://en.wikipedia.org/wiki/Main_Page
Other Learning Materials	• Neaman D. A., Semiconductor Physics & Devices – Basic Principles, 4th edition, McGraw Hill edition, 2011. • M. S. Tyagi, Introduction to Semiconductor Materials and Devices, John Wiley& Sons, 2008. • Pallab Bhattacharya, semiconductor optoelectronic devices, Pearson Education, Second edition (2017).

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Classroom
Technology Resources (AV, data show, Smart Board, software, etc.)	• Data show • Laptop • Smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Student Feedback on Effectiveness of Teaching	Students	Indirect
Evaluation of Teaching	• Instructor • Program coordinator • Departmental council Faculty council	Indirect
Improvement of Teaching	• Program coordinator • Program committee	Direct
Quality of learning resources	• Students • Instructor • Faculty	Indirect
Extent of achievement of course learning outcomes	• Program coordinator • Instructor	Direct
Course effectiveness and planning for improvement	• Program coordinator • Instructor	Indirect

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	Dr. Marwa Enneffati
Reference No.	
Date	October 2, 2022