هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

Course Specification
(Bachelor)

Course Title	**Semiconductor Physics**
Course Code:	**PHY 1426**
Program:	**Bachelor of Science in Physics.**
Department:	**Physics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	1
Last Revision Date:	***26/09/2024***

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐ College	☒ Department	☐Track	☐Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (Level 7 or 8/ Year4)					
4. Course General Description:					
This course provides the basics and principles of semiconductor devices. The major objective is to familiarize the students with the basic principles of operation of modern semiconductor devices such as p-n junction diode, light emitting diodes, JFET transistor, bi-polar transistors, etc.					
5. Pre-requirements for this course (if any)**:**					
Electronics, PHY 1324					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

At the end of this course the student will be able to:

- **Provide undergraduate students with a wide background and the ability to deal with advanced concepts in semiconductor devices.**
- **Describe the basic devices of semiconductor for the specific application.**
- **Provide the different parameters of semiconductor devices.**
- **Discuss aspects of the effects of semiconductors on the physical science.**
- **Develop critical thinking and analytical problem-solving skills.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**30**
2.	**Laboratory/Studio**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**30**
5.	**Others (specify)**	**0**
Total		60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Outline the basics and principles of semiconductor devices.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. Discussions.
1.2	**Outline the physical insight in the properties of semiconductors.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.3	**Describe the key principles and applications of Semiconductor Physics.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
2.0	**Skills**			
2.1	**Explain and summarize the basic knowledge gained from studying semiconductor physics course.**	**S1, S2**	▪ Lectures. ▪ Class discussions. ▪ Tutorials.	▪ Exams. ▪ Discussions. ▪ Participation.
2.2	**Develop the students ability to solve and analyze problems in physics related the topics covered by the course.**	**S2, S3**	▪ Problem classes and group tutorial. • Homework assignments as well as problems solutions.	▪ Exams. ▪ Discussions. ▪ Homework.
2.3	**Communicate in a clear and concise manner orally, and**	**S4, S5**	• Lectures. • Class discussions. • Tutorials.	▪ Exams. ▪ Participation and activities of students in the

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	using IT for acquiring and analyzing information.		• Encourage students to use electronic mail and internal network for submitting homework and assignments. • Use digital library.	course community and blackboard. ▪ Homework.
3.0	**Values, autonomy, and responsibility**			
3.1	**Show the collaboration and inter-professionalism in class discussions or team works, as well as solve problems independently.**	**V1, V2, V3**	• Small team tasks • Open discussion at classroom. • Office hours.	▪ Participation. ▪ Homework. ▪ Mini-project(s).

C. Course Content

No	List of Topics	Contact Hours
1.	**Generalities on Semiconductors:** Introduction presents a summary of the physics and properties of semiconductors, energy bands in semiconductors, electronic structure; electrons in periodic structures, effective mass and semiconductor band gap.	**12**
2.	**Charge Carrier Population:** Intrinsic concentrations; doped semiconductors, N-type and P-type semiconductors, Fermi level at equilibrium.	**10**
3.	**Electrical Conductivity:** Carrier transport phenomena, Quasi-classical approach, carrier mobility for a non-degenerate electron gas, high field transport and hot carrier effects.	**10**
4.	**p-n junction:** Space charge distribution, electronic energy bands in the space charge region; p-n junction under an applied voltage; p-n junction capacitance.	**10**
5.	**Metal-Semiconductor Contacts:** Band structure and electronic properties, metal-semiconductor devices.	**10**
6.	Transistors: Bipolar transistor, JFET transistor	**8**
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Class Activities (class quizzes, homework, solving problems, etc.....)	weekly	10 %
2.	Midterm Exam 1	4thweek	25 %
3.	Midterm Exam 2	6thweek	25 %
4.	Final Exam	16thweek	40 %

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Sze S. M., Physics of Semiconductor Devices, Wiley-Interscience (1969).
Supportive References	- Pierret R.F., Semiconductor Device Fundamentals, 2nd Edition (1996). - Yu P.Y., and Cardona M., Fundamentals of Semiconductors, Physics and Materials Properties, 2nd Edition, Springer, Berlin, (1999).
Electronic Materials	https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	- Classrooms. - Labs.
Technology equipment (projector, smart board, software)	- Classroom equipped with a whiteboard and a projector.
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students Second examiner	Indirect (The students complete the evaluation forms at the end of term. Final exam is evaluated by the second examiner)
Effectiveness of Students assessment	Instructors	Direct (exams, HW, project, …)
Quality of learning resources	Faculty Students	indirect (surveys)
The extent to which CLOs have been achieved	Instructors Program Leaders	Direct (excel sheet)
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Quality Unit-Physics Department
REFERENCE NO.	Department council No. 06
DATE	26/09/2024