Course Specification
(Bachelor)

Course Title: Semiconductors
Course Code: PHYS 0484
Program: BSc in Physics
Department: Physics
College: College of Science
Institution: Majmaah University
Version: 2
Last Revision Date: 30 2/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: 3 (3, 0, 0))					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered:					
4. Course General Description:					
a) Aim of this course is to provide a base to students for their future research and study planning. **b) After successful completion of this course, students will be able to understand Fundamentals of Semiconductors, Physics and working principles of P-N Junctions, Bipolar Junction Transistors, MOS Capacitors and MOS Field-Effect-Transistors.**					
5. Pre-requirements for this course (if any)**:**					
Solid State Physics 1 PHYS 0381					
6. Co-requisites for this course (if any)**:**					
NA					
7. Course Main Objective(s):					
The aim of this course is to provide the fundamentals of Semiconductors.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	35	80
2	E-learning	5	10
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning	5	10

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	45
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		45

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**			
1.2	Recognizing the different mechanical properties and interpreting them.	**K2**	Lectures In-class discussions Exercises	Exams Homework Classwork Quizzes
2.0	**Skills**			
2.1	Analyzing the stress-strain diagrams and extracting all necessary information from them.	**S1**	Lectures In-class discussions Exercises	Exams Homework Classwork Quizzes
2.4	Discriminating between the different types of phase diagrams and extracting all necessary information from it.	**S4**	Lectures In-class discussions Exercises	Exams Homework Classwork Quizzes
3.2	Learn how to search for information through the library and the internet.	**V2**	Class discussions. Making students aware about time management. Counsel students on how to make a good presentation.	Evaluation of group reports and individual contribution within the group. Self-assessment

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
			Encourage students to help each other	

C. Course Content

No	List of Topics	Contact Hours
1.	Semiconductor Fundamentals Carrier distribution functions, Carrier densities, Carrier Transport	4
2.	Carrier recombination and generation, Continuity equation, The drift-diffusion model	9
3.	P-N Junctions: Electrostatic analysis of a P-N diode, The P-N diode current, Reverse bias breakdown	7
4.	Bipolar Junction Transistors: Structure and principle of operation, Ideal transistor model, Non-ideal effects, Base and collector transit time effects, BJT circuit models, BJT Technology.	9
5.	MOS Capacitors: Structure and principle of operation, MOS analysis	6
6.	MOS Field-Effect-Transistors: Structure and principle of operation, MOSFET models, Threshold voltage, MOSFET Circuits and Technology	9
Total		**45**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	First exam	7	**15**
2.	Second exam	12	**15**
3.	Final exam	End of the semester	**40**
4.	Homework	Every week	**10**
5.	E-exam	one time/ semester	**5**
6.	Quizzes	End of topics	**5**
7.	Presentation/Discussions	one time/ semester	**10**

*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	▪ Physics of semiconductor devices, S.M. Sze, Wiley, (1981). ▪ Semiconductor Physics and Devices, D. Neamen, McGraw Hill, 3rd Ed., 2003.
Supportive References	▪ Journal of Applied Physics ▪ Applied Physics Letters ▪ Physical Review B ▪ Journal of Semiconductor Technology
Electronic Materials	▪ http://demonstrations.wolfram.com ▪ http://www.engineersedge.com/manufacturing_menu.shtml ▪ http://www.nist.gov/mml/ ▪ http://www3.fi.mdp.edu.ar/ingpolimeros/en ▪ http://faculty.mu.edu.sa/mkamran
Other Learning Materials	▪ Excel software for drawing graphs in the lab. ▪ MS Office for writing reports and presentations.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Furnished Lecture Room equipped with smart board and computer.
Technology equipment (projector, smart board, software)	Computational Lab with proper software.
Other equipment (depending on the nature of the specialty)	Library, Seminar Room, and Wi-Fi internet connections.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Subject Teacher	Statistical Analysis
Effectiveness of Students' assessment	Quality Director	Survey
Quality of learning resources	Subject Teacher	Meetings with Students
The extent to which CLOs have been achieved	Program Leaders	Survey
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**Department council**

REFERENCE NO.	**16**
DATE	**30/12/2024**