King Fahd University of Petroleum and Minerals
Department of Physics

PHYS336 – Physics of Semiconductor Devices
Fall 2022 (Term 221)

Instructor: Dr. Burhan SaifAddin
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Off. Hours: Sunday, Monday, Tuesday & Wednesday: 9:30AM - 10:30AM or by appointment.

Course:

Electronic structure of isolated atoms; atoms bonding, crystal structure, energy bands in solids; electrons and holes in semiconductors, drift and diffusion, mobility, recombination and lifetime, conductivity; PN junctions, I(V)characteristic, applications; photo detectors, Light emitting diodes, Solar-cell, Bipolar transistor, MOSFET and JFET, Semiconducting Lasers.

Prerequisite: PHYS 102

TextBook:

- *Semiconductor Physics and Devices* by Donald A. **Neamen** (3rd edition), McGraw Hill, (2003)

Optional References:

- *Solid State Electronic Devices* by Ben G. **Streetman**, Prentice Hall, 1995.
- **Pierret**, Robert. F. *Semiconductor Device Fundamentals*. Reading, MA: Addison-Wesley, 1996. ISBN: 9780201543933.
- **Livingston**, James D. *Electronic Properties of Engineering Materials*. New York, NY: Wiley, 1999. ISBN: 9780471316275.
- *Electrical Properties of Materials*, L. **Solymar** and D. **Walsh**, Oxford University Press, 8th Edition, 2004.
- U. K. **Mishra** & J. **Singh**, *Semiconductor Device Physics and Design*
- S. M. **Sze**, *Physics of Semiconductor Devices*

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Week #	Dates	Topics	Reading Assigment	
			Ch.	Sec.
1	Aug. 28 – Sep. 1	The Crystal Structure of Solids, Imperfections, Fabrication of Semiconductor Materials & Devices	**1**	**1–7**
2	Sep. 4 – 8	Introduction to Quantum Mechanics and the applications of Schrodinger Equation	**2**	**1–4**
3	Sep. 11 – 15	Introduction to the Quantum Theory of Solids: Energy Bands in Solids, and Density of States	**3**	**1–5**
4	Sep. 18 – 20	The Semiconductor in Equilibrium, Charge Carriers and Statistics of Donors/Acceptors	**4**	**1–3,5–6**
	Thurs. Sep 22	*National Day makeup (no-classes)*		
5	**Major Exam 1: Sep. 26, 2022: Chapters 1-4**			
	Sep. 25 – 29	Carrier Transport Phenomena: drift, diffusion. The Hall effect	**5**	**1–2,4**
6	Oct. 2 – 6	Non-equilibrium excess carriers in Semiconductors, Quasi Fermi Levels, SRH recombination, Surface effects	**6**	**1–2**
7	Oct. 9 – 13	PN Junction	**7**	**1–3**
8	Oct. 16 – 20	PN Junction Diode	**8**	**1–4**
9	**Major Exam 2: Oct 24, 2022, Chapters 5-8**			
	Oct. 23 – 27	Metal-Semiconductor and Semiconductor Hetero-junctions	**9**	**1–3**
10	Oct. 30– Nov. 3	Optical devices: Optical Absorption, Solar Cells	**14**	**1–2, 4**
11	Nov. 6 – 10	Photoluminescence and Electroluminescence, Light Emitting Diodes	**14**	**4, 5**
12	Nov. 13 – 17	Laser Diodes and Photodetectors Two Terminal MOS Structure	**14 11**	**6, 3 1**
13	Nov. 20 – 24	MOS Field Effect Transistor (MOSFET)	**11**	**2–4**
		Midterm break (Nov. 27–Dec. 1)		
14	Dec. 4 – 8	Bipolar Junction Transistor (BJT)	**10**	**1–2**
15	Dec. 11 – 15	Optional topic Project Presentations	**10 or 15**	
16	Dec. 18	Review		
	Final Exam: TBD, Comprehensive			

Course Policy PHYS 203 - Sem192 (Spring 2020)

Attendance:
Attendance will be taken in every lecture. Students more than 5 minutes late will be given tardy (half presence). Any student accumulating more than 12 unexcused absences will be assigned a DN grade.

Homework:
Homework problems are assigned at the start of every chapter. Students are encouraged to do the homework in groups.

Quizzes:
There will be a quiz every week on **Tuesday** from the material covered in the previous week.

Exams:
There will be two major exams and a final exam. First major exam will be from Chapters 1-4, the second major exam will be from chapters 5-8 and the final exam will be comprehensive.

Grading:

Quizzes	10%
Homework	10%
Project	5%
Major 1	22.5%
Major 2	22.5%
Final Exam	25%

From	**To**	**Grade**
85	100	A+
75	84	A
70	74	B+
65	69	B
60	64	C+
55	59	C
50	54	D+
41	49	D
0	40	F

Grading Policy:

From	To	Grade
41	100	Pass
0	40	Fail