

Semiconductor Devices

Schedule

Fall 2023

Instructor: Ridha Kamoua
Stony Brook University

Week	Date	Topic	Textbook1	Textbook2
1	8/28	<ul style="list-style-type: none"> Introduction 		
	8/30	<ul style="list-style-type: none"> Crystal structure, Miller indices, crystal growth 	p. 1 – 16, chp. 1	p. 1 – 14, chp. 1
2	9/6	<ul style="list-style-type: none"> Principles of quantum mechanics 	p. 31 – 41, chp 2	p. 25 – 39, chp 2
	9/11	<ul style="list-style-type: none"> Energy band theory, concept of a hole 	p. 41 – 54, chp 2	p. 58 – 63, 72 - 82, chp 3
3	9/13	<ul style="list-style-type: none"> k-space diagram Effective mass Charge Carriers and Current Density of States, Fermi Dirac distribution 	p. 52 – 54, chp 2 p. 49 – 50, chp 2 p. 47 – 49, chp 2 p. 55 – 64, chp 2	p. 83 – 85, chp 3 p. 75 – 77, chp 3 p. 72 – 75, chp 3 p. 85 – 98, chp 3
	9/18	Carrier Densities and Intrinsic semiconductor	p. 70 – 82, chp 3	p. 106 – 117, chp 4
4	9/20	<ul style="list-style-type: none"> Semiconductor Doping n and p in terms of doping 	p. 83 – 101, chp 3 p. 102 – 115, chp 3	p. 118 – 128, chp 4 p. 128 – 147, chp 4
	9/25	<ul style="list-style-type: none"> Carrier drift, diffusion, mobility 	p. 128 – 153, chp 4	p. 156 – 175, chp 5
5	9/27	<ul style="list-style-type: none"> Relation between mobility and diffusion coef. Generation – Recombination 	p. 152, chp. 4 p. 153 – 164, chp 4	p. 176 - 179, chp. 5 p. 192 – 197, chp 6
	10/2	Continuity equation	p. 358 – 384, chp 8	p. 198 – 210, chp 6
6	10/4	Exam 1 Review		
	10/11	Exam 1		

Week	Date	Topic	Textbook1	Textbook2
7	10/16	● pn junction under equilibrium	p. 174 – 185, chp 5	p. 241 – 250, chp 7
	10/18	built in voltage electric field, voltage	p. 174 – 185, chp 5	p. 241 – 250, chp 7
8	10/23	● Reverse and forward biased pn junction	p. 185 – 199, chp 5	p. 251 – 257, chp 7 p.277 – 278, chp 8
	10/25	● Ideal current-voltage characteristics	p. 404 – 420, chp 9	p. 278 – 293, chp 8
9	10/30	● Small-signal model ● Nonidealities: R-G, breakdown	p. 428 – 434, chp 9 p. 434 – 445, chp 9	p. 304 – 314, chp 8 p. 295 – 302, chp 8 p. 258 – 262, chp 7
	11/1	● BJT principles of operation ● Minority charges and I-V characteristics	p. 460 – 471, chp 10 p. 472 – 482, chp 10	p. 491 – 500, chp 12 p. 501 – 508, chp 12
10	11/6	● Current gain factors and Nonideal Effects ● Nonideal Effects	p. 483 – 494, chp 10 p. 495 – 512, chp 10	p. 509 – 521, chp 12 p. 522 – 530, chp 12
	11/8	● MOS Capacitor: work function difference	p. 227 – 244, chp 6	p. 371 – 385, chp 10
11	11/13	Exam 2 Review		
	11/15	Exam 2		
12	11/20	MOS capacitor: flat-band and threshold voltage	p. 245 – 257, chp 6	p. 385 – 393, chp 10
	11/27	● MOS capacitor: oxide charge, flat band voltage, threshold voltage	p. 245 – 257, chp 6	p. 382 – 393, chp 10
13	11/29	MOS C-V Characteristics	p. 258 – 267, chp 6	p. 394 – 403, chp 10
	12/4	MOSFET principle of operation	p. 268 – 281, chp 6	p. 403 – 410, chp 10
14	12/6	MOSFET principle of operation, I -V	p. 282 – 287, chp 6	p. 410 – 419, chp 10
	12/11	Review		

Textbook 1: “*An Introduction to Semiconductor Devices*” Donald Neamen,
McGraw Hill, 2006, ISBN 9780072987560

Textbook 2: “*Semiconductor Physics and Devices*” Donald Neamen,
McGraw Hill, 2011, ISBN 9780073529585