ENSC-324 Fall 2018

SEMICONDUCTOR DEVICES

INSTRUCTOR: Marek Syrzycki marek@cs.sfu.ca, ASB 8837

TEACHING ASSISTANTS: Yiqi Jia yiqij@sfu.ca
David Stevens mailto:david_stevens@sfu.ca

LECTURES: Tuesday, 08:30 - 10:20, K 9500
Thursday, 08:30 - 09:20, AQ 3182

TUTORIAL: Thursday, 09:30 - 10:20, AQ 3182

FINAL EXAM: Dec.10, 2018, Monday, 12:00 - 15:00

OFFICE HOURS: Yigi Jia, ASB 10814 (TA Room), Wednesdays, 10:00-11:00
Marek Syrzycki, ASB 8837, Tuesdays, 10:30-11:30
David Stevens, ASB 10814 (TA Room), Thursdays, 10:30-11:30

COURSE GRADING POLICIES:

Quizzes (4 - 15% each)	60%
Homework Assignments (4)	10%
Final Exam	30%

Taking all Quizzes is mandatory. No makeup Quizzes are planned. For those who will have a misfortune to be very seriously sick (with an appropriate medical documentation proving the case) and skip one Quiz, the modified policy below will be applied:

Quizzes (3 - 15% each)	45%
Homework Assignments (4)	10%
Final Exam	45%

Any student who misses more than one Quiz, will loose up to 15% of the final mark.

OTHER POLICIES:

1. The course lecture slides will be available on the course web page: http://www2.ensc.sfu.ca/people/faculty/syrzycki/324/ for a download. It is strongly recommended to become familiar with them before the lecture for better understanding and involvement during lectures. You must keep the web site's password for yourself and do not give it to anybody else.
2. You may not tape Lectures, Tutorials, Quizes and Exam in any form.
3. Homeworks will focus on problems that may be given during Quizes and Final Exam. You should solve them for your own benefit.
4. Aiming to become Professional Engineer in future, be very aware of SFU's Academic

Integrity Policy (http://www.sfu.ca/policies/gazette/student/s10-01.html). The University in general, and Engineering Science in particular, have zero tolerance for cheating. **I have zero tolerance for cheating**. Possible penalties include: failure in a particular assignment, failure in the course, a written dishonesty record on file, a FD (Failed for Dishonesty) record on a transcript, and suspension/expulsion from the university. Academic dishonesty is taken very seriously in our School.

5. Students who score 60% or more on all four Quizzes do not need to take the Final Exam. Their final grade will be calculated as 90% (Quizzes) and 10% (Homework Assignments).

TEXTBOOK:

- Ben G. Streetman and Sanjay Kumar Banerjee, "**Solid State Electronic Devices**", Pearson, 7th Ed., 2015, ISBN-10: 0-13-335603-5, ISBN-13: 978-0-13-335603-8.

COURSE WEB SITE:

It will be at: http://www2.ensc.sfu.ca/people/faculty/syrzycki/324. The id and password to use it will be e-mailed to all students registered in the course. Please do not share the id and password with others.

SFU LIBRARY WEB SITE with SILICON RUN series movies:

https://sfu-primo.hosted.exlibrisgroup.com/primo-explore/search?query=lsr31,exact,Silicon run series.,AND&sortby=rank&vid=SFUL&mode=advanced

- **Silicon Run. I**
- **Silicon Run. II**
- **Silicon Run Lithography**
- **Silicon Run Etch**
- **Silicon Run Deposition**
- **Silicon Run Implantation**
- **Silicon Run Lite**

TENTATIVE SCHEDULE OF LECTURES:

Lecture	Quiz	Week	Date	Topic
1 2		1	Sep 4 Sep 6	Atoms and electrons (Sec. 2.1 to 2.5.). Crystal properties (Sec.1.1, 1.2). Growth of semiconductor crystals (Sec.1.3, 1.4).
3 4 H1		2	Sep 11 Sep 13	Energy bands in solids (Sec. 3.1), Charge carriers (Sec. 3.2, 3.5). Carrier concentrations (Sec.3.3). Drift of carriers in electric and magnetic fields (Sec. 3.4).
5 H1 due 6		3	Sep 18 Sep 20	Excess carriers in semiconductors. Carrier lifetime and photoconductivity (Sec. 4.1 to 4.3). Diffusion, generation and recombination of carriers. The continuity equation (Sec.4.4).
7 8 H2	**Q1**	4	Sep 25 Sep 27	Fabrication of p-n junctions (Sec. 5.1). Equilibrium conditions (Sec.5.2). Forward- and reverse-biased p-n junction; Steady-state conditions (Sec. 5.3).
9 H2 due 10		5	Oct 2 Oct 4	Reverse-bias breakdown (Sec. 5.4). Transient and AC conditions. Switching and p-n junction capacitances (Sec. 5.5). Deviations from the simple theory (Sec.5.6).
11 12	**Q2**	6	Oct 9 Oct 11	Metal-semiconductor junctions (Sec.5.7). Photodiodes (Sec.8.1) Diode model in SPICE (Lecture notes).
13 14 H3		7	Oct 16 Oct 18	Field effect transistors. (Ch.6). The junction FET (Sec.6.2-6.3). Metal-Oxide-Semiconductor (MOS) capacitor - operation, characteristics and parameters (Sec.6.4).
15H3due 16		8	Oct 23 Oct 25	MOS Field-Effect Transistor (FET) - operation and basic parameters (Sec.6.5).
17 18	**Q3**	9	Oct 30 Nov 1	MOS FET - electrical characteristics and second-order effects (Sec.6.5).
19 20 H4		10	Nov 6 Nov 8	MOS FET model in SPICE (Lecture notes). Bipolar Junction Transistor (BJT) - structure and operation (Sec.7.1 to 7.3).
21H4due 22		11	Nov 13 Nov 15	Minority carrier distributions and terminal currents (Sec.7.4). BJT biasing and I-V characteristics (Sec. 7.5).
23 24	**Q4**	12	Nov 20 Nov 22	BJT switching operation (Sec.7.6). Important effects in BJTs (Sec.7.7).
25 26		13	Nov 27 Nov 29	Frequency limitations of BJTs (Sec.7.8). BJT model in SPICE (Lecture notes).
27		14	Dec 10	FINAL EXAM 12:00 - 15:00, Room: TBA