Physics 3000: Physics of Device Materials. Fall 2024

Slot 9: Monday, Wednesday, and Friday, 4:00 – 4:50 p.m. EN-1054

Prerequisite: Physics 1051

Course description on department web page:
http://www.mun.ca/physics/undergraduates/syllabus/p3000.php

Instructor: Dr. Mykhaylo (Misha) Evstigneev. Rm C-3025. Phone 864-2474.
Email: mevstigneev@mun.ca.

Preferred method of communication: course mail on Brightspace

Office Hours: Wednesday, 12 – 2 p.m. in C-3025 or by appointment

Course web page: See Brightspace

Texts and Resources

Required: M. Evstigneev. *Introduction to Semiconductor Physics and Devices* (Springer, 2022)

Supplementary:

C. Hu. *Modern Semiconductor Devices for Integrated Circuits* (Prentice Hall, 2010).
D. Neamen. *Semiconductor Physics and Devices* (McGraw-Hill, 2012).
D. Neamen. *An Introduction to Semiconductor Devices* (McGraw-Hill, 2006).
J.P. Collinge and C.A. Collinge. *Physics of Semiconductor Devices* (Springer, 2002).
S.M. Sze and M.K. Lee. *Semiconductor Devices* (John Wiley & Sons, 2012).

Some of these texts are made available online by the authors or the publisher.

Course Outline (about 3 lectures per topic)

Part 1: Fundamental physics (to be covered in Midterm 1 and Final Exam)

1. Principles of quantum mechanics
2. Crystal structure of solids
3. Equilibrium statistical mechanics
4. Band theory of solids

Part 2: Semiconductors in and out of equilibrium (to be covered in Midterm 2 and Final Exam)

5. Semiconductors in equilibrium
6. Carrier concentration and electric potential
7. Generation-recombination processes
8. Carrier transport

Part 3: Semiconductor devices (to be covered in Final Exam)

9. Metal-semiconductor contact
10. Metal-oxide-semiconductor field effect transistor
11. P-N junction diode
12. Optoelectronic devices

Mode of delivery. You are expected to familiarize yourselves with the content of the upcoming lecture before each meeting by reading the literature. In addition, the problems to be discussed in each meeting will be posted a few days in advance, and you are expected to attempt those problems. In the meetings, I will briefly review the pertinent theoretical material, answer your questions, and discuss the solution of the problems. Questions emailed to me before the meeting will be given first priority.

Method of Evaluation

Homework assignments (weekly)	10% (= 10 assignments, 1% each)
Mid-term test 1 (Fri., Oct. 10)	20%
Mid-term test 2 (Fri., Nov. 14)	20%
Final exam (date t.b.a.)	50%
Final exam bonus problems	5%

Supplementary exam, if needed, will be provided according to the University regulations explained at https://www.mun.ca/university-calendar/st-johns-campus/faculty-of-science/8

Use of assistive tool. Feel free to use AI as a learning tool for your homework assignments, but midterms and the final exam will be closed-book, with no assistive tools, including AI, allowed.

Supplemental instruction sessions will start in the second week of classes. Their schedule will be posted at https://www.mun.ca/engineering/undergraduate/engineering-one/supplemental-instruction/.

Possible changes. In the case of a class disruption or cancellation, and in the case of revisions to evaluation methods, the instructor or the Head of the department will notify all students registered in the course via the course shell in Brightspace. Any necessary revisions to the evaluation methods will be made in consultation with the students registered in this course. If a student demonstrates that they would be disadvantaged by the change, then, as per 6.7.4 of the University Calendar, accommodations will be made.

Missed midterms. The midterm exams will be conducted in-class. If a student misses a midterm, its weight will be transferred to the respective part of the final exam that covers the same material as the missed midterm. Those students who still wish to write the missed midterms may consult the University Calendar, Section 6.7.5 (https://www.mun.ca/regoff/calendar/sectionNo=REGS-0601) and speak to the instructor.

Final examinations. Information about scheduling, deferral, evaluation and re-reading of the final examination script can be found in Section 6.8 of the University Calendar, see http://www.mun.ca/regoff/calendar/sectionNo=REGS-0628 .

Accommodations for students with dis8abilities are provided within the scope of the University Policies (www.mun.ca/policy/site/policy.php?id=239). Students who may need an academic accommodation are asked to initiate the request with the Glenn Roy Blundon Centre, see http://www.mun.ca/blundon/.

Use of recording devices. The lectures, displays, and all material delivered or provided in this course, including any visual or audio recording thereof, are subject to copyright owned by Dr. Evstigneev. It is prohibited to record or copy by any means, in any format, openly or surreptitiously, in whole or in part, in the absence of express written permission from Dr. Evstigneev any of the lectures or materials provided or published in any form during or from the course.

Academic misconduct. Students are expected to adhere to those principles which constitute proper academic conduct. A student has the responsibility to know which actions, as described under Academic Offences in the University Regulations, could be construed as dishonest or improper. For more information regarding this policy, students should refer to Section 6.12 in the University Calendar at http://www.mun.ca/regoff/calendar/sectionNo=REGS-0748.