

ELEC4705A [32249] Elec Mat, Dev & Trans Media (LEC) Fall 2020

[Dashboard](#)

Course Page

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Suggested Reading;

Electronic properties of materials.

Hummel, Rolf E., 1934- 2nd ed. Berlin, Springer-Verlag. 1992 404 p.

CALL NUMBER: QC176.H86 1993

[Principles of Electronic Materials and Devices - Safa Kasap](#)

There is a great deal of material books, lectures, notes, and public domain information dealing with the course material. It would be wise to do supplemental reading. The lectures will delimitate the material to be covered.

Matlab code for "toy" simulators used to illustrate a number of physical effects are in the git repository at [4700Code](#). Students are encouraged to goto the repo (it is public) create a branch identified by their name and enhance, debug the code. This effort will be worth bonus marks if significant.

Mark Breakdown

Marks

Final: 40.00%

Tests: Four at 15% each -- **you must take at least 3 quizzes to pass the course.**

The mark weight on any quiz that has a lower mark than that of the final will be automatically transferred to the final.

For example if you get 75% on the final and 0%, 65%, 85%, 85% on the three quizzes, I will calculate your mark as

$$75%*(0.40+0.30) + 85%*0.30$$

TA info:

Scott Stewart (Scott.Stewart at carleton.com)

Is available for consultation on the course material. Email him for appointments.

Link Password:

The links in the sections below go to the old website for the page and can be accessed by using the user id 4705 and password model.

 [Announcements](#)

Quizzes

This Years Quizzes:

1) Sept. 30 (Wed.)

2) Oct. 19 (Mon.)

3) Nov. 11 (Wed.)

4) Nov. 30 (Mon.)

Last Years Quizzes:

- 1) Sept. 28 (Fri.) [solution](#)
- 2) Oct. 31 (Wed.) [solution](#)
- 3) Nov. 9 (Fri.) [solution](#)
- 4) Nov. 30 (Fri.) [solution](#)

Two Years Ago Quizzes:

- 1) Sept. 28 (Fri.) [solution](#)
- 2) Oct. 31 (Wed.) [solution](#)
- 3) Nov. 9 (Fri.) [solution](#)
- 4) Nov. 30 (Fri.) [solution](#)

Lectures

[lecture 0: Intro Lecture \(Sept. 9\)](#)

[lecture 1: : Classical Physics \(Sept. 14\)](#) [Old](#) [Key Slides and Questions](#)

[lecture 3: Introduction to Quantum \(Sept. 16\)](#) [Old](#) [Key Slides and Questions](#) [Good book!](#) [Another book!](#) [Things Get Real!](#)

Sean Carrol on Joe Rogan (Course language likely)

[lecture 4: Electron WavePackets \(Sept. 21\)](#) [Old](#) [Key Slides and Questions](#)

[lecture 5: Wells and Electrons \(Sept. 23\)](#) [Old](#) [Key Slides and Questions](#)

[lecture 6: Tunneling \(Sept. 28\)](#) [ppt](#) [Key Slides and Questions](#)

Quiz 1 Sept. 30 (Wed.) (Lectures 1-6 inclusive)

[lecture 7: Crystals \(Oct 5\)](#) [Old](#) [Key Slides and Questions](#)

[lecture 8: Bands and Conduction \(Oct 7\)](#) [Old](#) [Old2](#) [Key Slides and Questions](#)

[lecture 9: Introduction to Semiconductors \(Oct 12\)](#) [Old](#) [Key Slides and Questions](#)

[lecture 10: Optical Effects and Transport \(Oct. 14\)](#) [ppt](#) [Key Slides and Questions](#)

Quiz 2 Oct. 19 (Mon.) (Lectures 7-10 inclusive)

[lecture 11: Schottky and PN Diodes \(Oct. 21\)](#) [ppt](#) [Key Slides and Questions](#)

Break week for Oct. 26 and Oct.30

[lecture 12: Bipolar Transistors \(Nov 2\)](#) [Key Slides and Questions](#)

[lecture 13: Field Effect Transistors \(Nov 4\)](#) [Key Slides and Questions](#)

[lecture 13: Field Effect Transistors \(Nov. 4\). Key Slides and Questions](#)

[lecture 14: Optical Systems \(Nov. 9\). Key Slides and Questions](#)

Quiz 3 Nov. 11 (Wed) (Lectures 11-14 inclusive)

[lecture 15: Lasers, LEDs, Solar Cells and Photo-diodes \(Nov. 16\). Key Slides and Questions](#)

[lecture 16: IC Fabrication \(Nov. 18\) Key Slides Questions](#)

[lecture 17: MEMS \(Nov. 23\). Key Slides Questions](#)

[lecture 18: Nano \(Nov. 25\). Cool cars on chips Key Slides Questions](#)

Quiz 4 Nov. 30 (Mon.) (Lectures: 15-18 inclusive)

[lecture 19: Nano dots and quantum effects \(Dec 2\). Key Slides Questions](#)

lecture 20: (Dec 7) review and discussion.

Example Finals

[Example Final \(2018\)](#)

[Equations you must know!](#)

Old Lectures

These lectures are from a previous version of the course and cover a lot of the same material, but are in a more discursive format.

[lecture 2: Classical Physics!](#)

[lecture 3: Basic QM!](#)

[lecture 4: Wave Packets!](#)

[lecture 5: Electron in a Box!](#)

[lecture 6: QM Tunnelling!](#)

[lecture 7: Electron in Crystal!](#)

[lecture 8: Band Structures and Conduction!](#)

[lecture 9: Filling the bands and n and p!](#)

[lecture 10: Semiconductors and carrier flow!](#)

[lecture 11: Light!](#)

[lecture 13: Diodes \(Schottky and pn\)!](#)

[lecture 14: BJT!](#)

[lecture 15: MOSFET!](#)

[lecture 16: IC Fabrication](#)

[lecture 17: MEMS](#)

[lecture 18: Nano](#)

[lecture 19: Nano dots and quantum effects](#)

[lecture 20: Optical Systems!](#)

[lecture 21: Optical Amp/Lasers/Detectors!](#)

Course Content Learning Objectives

Upon successful completion of this course students will be able to:

1. Describe the relationship between Classical and Modern Physics
2. Present a basic understanding of Quantum Mechanics and its implications
3. Be able to describe the physics of an electron in a finite and infinite well
4. Describe the physics of quantum mechanical tunneling.
5. Explain the origin and physics of a band structure and its implications
6. Explain the behavior of electron in crystals by using the concept of a band structure.
7. Describe the physics of carrier flow in semiconductors.
8. Explain the basic operation of the electronic devices: BJT, Mosfet and diodes.
9. Explain the basic operation of the photonic devices: photodiodes, laser and fiber
10. Provide a description of Micro-machining, nano-technology and IC fabrication.



Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows: Pregnancy obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Equity Services website <http://www2.carleton.ca/equity/accommodation/> Religious obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Equity Services website <http://www2.carleton.ca/equity/accommodation/> Students with disabilities requiring academic accommodations in this course must register with the Paul Menton Centre for Students with Disabilities (PMC) for a formal evaluation of disability-related needs. Documented disabilities could include but are not limited to mobility/physical impairments, specific Learning Disabilities (LD), psychiatric/psychological disabilities, sensory disabilities, Attention Deficit Hyperactivity Disorder (ADHD), and chronic medical conditions. Registered PMC students are required to contact the PMC, 613-520-6608, every term to ensure that I receive your Letter of Accommodation, no later than two weeks before the first assignment is due or the first in-class test/midterm requiring accommodations. If you only require accommodations for your formally scheduled exam(s) in this course, please submit your request for accommodations to PMC by the deadlines published on the PMC website: <http://www2.carleton.ca/pmc/new-and-current-students/dates-and-deadlines/>

Student Support

TA Support

Instructor Support

ITS Service Desk Support: **Email** or **613-520-3700**



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