The course outline is for reference only.

Course outline is subject to changes and adjustments to fit the teaching in each term when offered as deemed appropriate by the course instructor.

ELEC 3500; Nicroelectronic Devices and Technology

Instructor: Mansun Chan

Room 2519; E=mail: mchan@ust.hk; Tel: 2358 8519; Fax: 2358 1485



Mansun han

Hong Kong University of Science & Technology, Department of Electronic & Computer Engineering

Information about this class

Personnel and Basic Information

- Instructor: Mansun Chan, Room 2519
- Office Hour: Available online most of the time
- TA: Cristine ESTRADA (cjdsestrada@connect.ust.hk) Zhesi CHEN (zchency@connect.ust.hk) Liying LIN (llinao@connect.ust.hk Renqiang ZHU (rzhuaf@connect.ust.hk)
 Lab in NFF, 3 Labs in Room 3121





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This course will be offered in blendedIearning mode in this semester



What does blended learning mean?

Course delivery

- Most of the course contents are pre-recorded and available online through edx.org https://edge.edx.org
- You may view the content any time, any where at your own pace
- More concise and structured material that you may repeat viewing in case you missed something
- You may discuss with your friends while watching the videos
- You may post questions immediately and got faster response





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Watching the videos [1]

Registering an account

- We have pre-enrolled you to edge.edx.org if you are already in the class
- You should have received an e-mail invitation and please register with your ITSC account
- If you have just added the class and do not have access to edge.edx.org, please send me a e-mail with your ITSC account information, I will add you to the class
- You should also send me your ITSC account information if you plan to added the class but not yet in the class





Watching the videos [2]

Working with edge.edx.org

- Lecture video, content related discussion and video related notes will be distributed through edge.edx.org
- You have to finish viewing ALL the videos before the corresponding lectures (part of your grade)
- It is like a self-served lecture room





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What about canvas?

It is the administrative portal

- Course announcement will be sent through canvas
- Handouts will be distributed through canvas
- Labs will be posted and collected through canvas
- Homeworks will be posted and collected through canvas
- Lab signups will be done through canvas
- Grades will be posted on canvas
- Administrative issues should be discussed through canvas discussion group





How to access iPRS?

You need a mobile device

Download HKUST iLearn app for iPRS







How to access iPRS?

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Download HKUST iLearn app for iPRS



- You are responsible for the connection and performance of your own mobile device
- Starting from the second lecture, all your iPRS answers will be counted





Topics to be Covered in ELEC3500 [1]



Topics to be Covered in ELEC3500 [2]

It maybe too early to introduce the topics

 If you know what the following are, you probably do not need to take this class

















Pre-requisite

Chemistry

- Actually you do not need to take any chemistry class from the university
- As long as you know the periodic table and atomic structure, it is good enough
- But I need your confirmation so that you will not blame me if you cannot follow the class because you do not know what a group IV element means

ELEC2400

- You do need to know what a circuit is
- You also need to know the concept of circuit models when an element is placed in a circuit
- This class explain how the elements work





Grading of ELEC3500

Approximate grade distribution

- 7% Viewing all videos
- 8% Homework
- 8% iPRS questions
- 10% Labs (online)
- 12% quizzes
- 45% final exam (online)
- 10% bonus for watching 90% videos on time, submitting all labs and classwork, taking all the exams, attempted 85% of the iPRS questions

You get an A if you score over 80% in the final exam

The bottomline

 if you get the 10% bonus points, you will likely get at least a "C" for the class





You Objective to Take This Class

- What is the most important reason for selecting this class?
 - 1. To learn how semiconductor works
 - 2. To get a high grade
 - 3. Passing the class with minimum effort
 - 4. Do not know, but the class fits my schedule





A little bit more about me

More background

- My specialty is in semiconductor, but most of my recent activities are not in the technical area
- I was once a qualified CFA (with a master degree in Finance)
- I was a manager some venture capital and have connection to investment funds
- I have been doing corporate training in creativity and management
- I have helped people to found a number of companies and still have many ideas for companies
- I do not believe the winners in the entrepreneurship competition can really run a company
- I read e-mail but seldom answer phone call, WeChat or whatapps
- You are welcome to talk to me in any subjects beyond the class





Philosophy of ELEC3500 [1]

Learn to study SMART, not study hard

- 50% versus 90% knowledge
- qualitative rather than quantitative
- Enter the world of electrons and feel how they move
- most important, develop common sense (which is usually not common)

The learning process

- Many things can be learnt, but not taught
- Advanced versus fundamental knowledge
- knowledge vs application of knowledge
- thinking vs memorization



Active learning: you are responsible to find out the questions

Philosophy of ELEC3500 [2]

Problem with conventional teaching

- Current education system was developed in the industrial revolution and does not evolve to the information era
- Still teaching knowledge while they are readily available
- School never tells students that the taught knowledge may become obsolete upon graduation
- Many skill based job will eventually be replaced by AI

Question

 2 weeks after taking a class, how much material can you still recall?

Conclusion

- I don't expect you can remember what you learned in this class
- Remembering them is useless anyway because they will become obsolete in 3-5 years





Philosophy of ELEC3500 [3]

What should be your focus in this class then?

- The language used so that you can talk like an expert
- Make approximate guesses and quick decision
- Know where to find the require information when needed
- "Appreciate" the ability to learn something new quickly
- Relax and get the big picture first before going to the details
- The class is designed to be the last class in the semiconductor area (not to prepare you for another class)

Engineering Approach

- Solving problems with approximate rather than perfect solutions
- If you are given a poor invention, you can make a poor product that works half the time and sell at half the price





Philosophy of ELEC3500 [4]

Difference between Scientist and Engineer

- Engineer focus on the question "how", not "why"
- We start from determining the problem and solve it
- Science start from a solution to look for problem/application
- Engineering is supposed to be a top down approach starting with a problem and look for THE MOST EFFICIENT solution



Example

- How do you prove f(x)=g(x) if you are a mathematician?
- What would you do if you are an engineer?



Philosophy of ELEC3500 [5]

What do I expect from you

- learn to be an engineer (decision maker), not a technician (machine operator)
- communicate well your difficulties and your view
- focus on the learning rather than the grade (or you will be very frustrated)
- If something is beyond your ability, take it as a blackbox, correlate the input and output, and move on
- Enjoy the class

What do you expect from this class

• you better tell me

Best strategy to take the class

• going for a "C" and get a "C" ☺ (for undergraduate)





OBE (Outcome Based Education) Definition Students will be able to

- communicate with the language of semiconductor (diode, BJT, MOSFET, doping, Fermi-level, drift-diffusion etc.
- describe the basic principles of some common circuit active elements plus photo active devices (solar cell, LED, CCD)
- describe the effects of changing the key physical parameters of diode, BJT and MOSFET on the trend (increase or decrease) of the output characteristics
- remember the operation of a cleanroom
 - operate a probe-station



match a given model to measurement data by selecting relevant parameters



Another Psychology Test

- If you get a poor grade in this class, who do you think should be most responsible for it?
 - 1. No one, I just want to pass the class
 - 2. Myself for not putting enough effort
 - 3. The instructor who is too tough on giving grades
 - 4. The education system that focus on examination rather than learning



