ELEC 2400 – 2021-22 Fall Electronic Circuits
(3 hours lecture, 1 hour tutorial, 3 hours lab : 4 credits)
Mixed-Mode Lite on Zoom

Prerequisites **Corequisites**	**ELEC 1100 and (MATH 1003 / 1014 / 1020 / 1024)** **PHYS 1114 / 1314**
Instructor	**Prof. Kevin CHAU, Room 2448, eekchau@ust.hk**
Demonstrator	**Ricky CHOI, eericky@ust.hk, mainly responsible for tutorials and supervision of TAs**
Teaching Assistants (TAs) **Technical Officers (TOs)**	**Please check the ELEC2400 Canvas page** **TAs mainly responsible for lab supervision, marking of lab reports, homework, and mid-term/exam papers** **TOs responsible for the technical support of the lab**
Objectives	**The course covers fundamental electronic concepts for DC and AC circuits, KVL and KCL, Thevenin's and Norton's theorems, linearity and superposition, nodal and mesh analyses, sinusoidal steady state and phasor representation, frequency response, transfer functions and Bode plot, op amps, transient and diode circuits.** **Upon completion of the course, students are expected to understand and use simple electronic circuits as functional building blocks and tools.**
Lecture Notes **Major References** **Other References**	**Lecture notes and videos will be available on Canvas: http://canvas.ust.hk.** **Mid-term and final exam will both be closed books and mainly based on the lecture and tutorial notes.** **D. V. Kerns and J. D. Irwin, *Essentials of Electrical and Computer Engineering*, Pearson, 2004.** **J. D. Irwin and D. V. Kerns, *Introduction to Electrical Engineering*, Prentice Hall, 1995.** **R. J. Smith and R. C. Dorf, *Circuits, Devices and Systems*, Wiley, 5th edition, 1992.**
Assessment	**Labs (4% x 5) 20 %** **Homework (3% x 5) 15 % Mid-term and final exam will include some similar questions** **Mid-term 25 % Oct. 20, 2021 (Wednesday), 7:30 – 9:00 pm** **Final Examination 40 % Dec. xx**

Class Timetable

Start Time	MON	TUE	WED	THU	FRI
9:00					LAB-LA2
9:30					
10:00	Ricky's Office Hour Rm 2395/Zoom				
10:30			LAB-LA1		
11:00					
11:30					
12:00		LECT		LECT	
12:30					
1:00					
1:30					
2:00		TUT-T2			
2:30					
3:00					TUT-T1
3:30					
4:00					
4:30	LAB-LA4	Kevin's Office Hour Rm 2448/Zoom			
5:00					LAB-LA3
5:30					
6:00				TUT-T3	
6:30					
7:00					
7:30					

Course Schedule (Tentative)

Week	Date	Lecture	Laboratory	Remarks	Kerns Book Chapter
1	Sep 1 – 3	Introduction		No Tutorial in the first week	1
2	Sep 6 – 10	Fundamentals		Lab starts in Week 4	1
3	Sep 13 – 17	DC Analysis		Release Homework 1	2
4	Sep 20 – 24	DC Analysis	Lab 1(a): Instruments		2
5	Sep 27 – Oct 1	AC Analysis	Lab 1(a): Instruments	Release Homework 2	4
6	Oct 4 – 8	AC Analysis	Lab 1(b): Instruments		4, 5
7	Oct 11 – 15	Op Amp	Lab 2: Pspice		9
8	Oct 18 – 22	Op Amp		Mid-term Content ~ Week 1 to 6 Release Homework 3	9
9	Oct 25 – 29	Frequency Response	Lab 3: Auto-tracking Vehicle (Digital Control)		7
10	Nov 1 – 5	Frequency Response	Lab 4: Auto-tracking Vehicle (Analog Control)	Release Homework 4	7
11	Nov 8 – 12	Transient Analysis			3
12	Nov 15 – 19	Transient Analysis	Lab 5(a): Audio Equalizer	Release Homework 5	3
13	Nov 22 – 26	Diodes	Lab 5(b): Audio Equalizer		10
13	Nov 29 – 30	Diodes			10

Lab Schedule

WEEK	DATE	MON	TUE	WED	THU	FRI
1	Sep 1 – 3					
2	Sep 6 – 10					
3	Sep 13 – 17					
4	Sep 20 – 24					Lab 1(a)
5	Sep 27 – Oct 1	Lab 1(a)		Lab 1(a)		
6	Oct 4 – 8	Lab 1(b)		Lab 1(b)		Lab 1(b)
7	Oct 11 – 15	Lab 2		Lab 2		Lab 2
8	Oct 18 – 22			Mid-term		
9	Oct 25 – 29	Lab 3		Lab 3		Lab 3
10	Nov 1 – 5	Lab 4		Lab 4		Lab 4
11	Nov 8 – 12					
12	Nov 15 – 19	Lab 5(a)		Lab 5(a)		Lab 5(a)
13	Nov 22 – 26	Lab 5(b)		Lab 5(b)		Lab 5(b)
13	Nov 29 – 30					

Lecture Topics

Week	Lecture
1	**Introduction**
2	**Fundamental Concepts** Charge, current, voltage, circuit modeling, lumped parameter model, Ohm's law, two-terminal element, reference direction, electric power, voltage and current sources, dependent sources, active and passive elements
3, 4	**DC Analysis** Circuit terminology, KCL, KVL, series/parallel connections, voltage/current dividers, nodal/mesh analyses, linearity, superposition, Thevenin's and Norton's theorems, source transformation
5, 6	**AC Analysis** Capacitor and inductor, sinusoidal excitation, steady-state and transient responses, complex number, phasor representation, magnitude and phase of steady-state response, impedance, AC power
7, 8	**Op Amp** Ideal op amp, voltage buffer, non-inverting amp, inverting amp, adder, difference amp, instrumentation amp, current source, negative impedance converter, V-to-I converter, ADC, DAC, differentiator, integrator
9, 10	**Frequency Response** Transfer function, poles and zeros, Bode plot, low-pass and high-pass filters, first and second order systems
11, 12	**Transient Analysis** Transient circuits, switch operations, RC and RL circuits, first order transient response
13	**Diode Circuits** Diode models, clipping and clamping circuits, half- and full-wave rectifiers, Zener diode, regulator, charge pump

Laboratory Policy

General

- There will be 5 lab experiments contributing toward 20% of the final grade.
- The necessary lab components and measuring kits will be distributed to you. You could try it out at home, and perform the experiments in the face-to-face lab on campus, which will be monitored and supervised by the teaching staffs.

Getting / Returning Lab Kits

- You can come to HKUST to pick up the lab kits in your registered lab session one/two week before the first lab, Sept 15 (LA1), Sept 17 (LA2), Sept 17 (LA3), and Sept 20 (LA4).
- You should return the lab kits after your last lab on Nov 24 (LA1), Nov 26 (LA2), Nov 26 (LA3), and Nov 22 (LA4).

Students approved to study remotely

- The lab kits will be sent to you via FedEx. The department will pay for the shipping and customs handling fees.
- You will perform the experiments at home during the lab sessions, which will be monitored and supervised by teaching staffs on Zoom.
- You should mail back the lab kits to us by Dec 22. The department will pay for the postage cost.

Grade Policy

- The course grade will not be released until your lab kits are received by us.

Homework Policy

General

- There will be 5 homework assignments contributing toward 15% of the final grade.
- Purpose is to pace the learning progress and to provide the necessary practice in solving circuit problems.
- Students are encouraged to discuss the homework assignments with each other. It is fine to learn from a classmate how to solve any of the homework problems, but each student is responsible for individually carrying out and writing/typing up the assignments. It is an Honor Code violation to copy the work of others.

Homework Submission

- Please submit your homework online https://canvas.ust.hk.
- Homework must be neatly written or typed up clearly showing all the steps and calculations. No marks will be given for unjustified answers.

Late Policy

- Homework is due at 11:59 pm on the due day.
- Each student is allowed a total of 5 free late days to use throughout the term at his or her discretion.
- Late days are counted by the date stamp every time a new homework submission is received after the due day. So if you submit homework one day late, and then resubmit it one day later, you use up 3 late days!
- Homework solutions will normally be released a few days (but no less than 3 days) after the due date.
- Late homework will not be accepted after the solution is posted or once all the late days are used up.
- You would need to keep track of your remaining late days.

Intended Learning Outcomes:

On successful completion of this course, students will be able to

CO1: Apply the fundamental circuit concepts to compute the output of basic electronic circuits in response to a DC input signal. (PO1, PO5)

CO2: Recognize sinusoidal steady state characteristics of basic electronic circuits using phasors and compute the output of basic electronic circuits in response to an AC input. (PO1, PO5)

CO3: Compute the transient responses of basic electronic circuits consisting of capacitors and inductors. (PO1, PO5)

CO4: Compute the characteristics of basic electronic circuits consisting of operational amplifiers and diodes. (PO1, PO5)

CO5: Employ electronic instruments and perform experiments. (PO2)

CO6: Apply CAD tools to simulate and analyze electronic circuits. (PO10, PO11)

ECE Program Outcomes:

PO1 – An ability to apply knowledge of mathematics, science and electronic and computer engineering.
PO2 – An ability to design and conduct experiments, as well as to analyze and interpret data.
PO3 – An ability to design efficient and economical electronic and computer engineering systems, components or process subject to practical constraints.
PO4 – An ability to function in a multi-disciplinary environment through teamwork.
PO5 – An ability to identify, formulate and solve electronic and computer engineering problems.
PO6 – An ability to understand professional practices and ethical responsibilities.
PO7 – An ability to communicate effectively.
PO8 – An ability to understand contemporary global, regional, economic, environmental, and social issues, and the corresponding role and the impact of electronic and computer engineers.
PO9 – An ability to recognize the need for, and to engage in life-long learning.
PO10 – An ability to use current techniques, skills and engineering tools necessary for solving electronic and computer engineering problems.
PO11 – An ability to use the computer/IT tools relevant to the electronic and computer engineering along with an understanding of their processes and limitations.