Carleton University

Faculty of Engineering and Design, Department of Electronics

ELEC 2507 Electronic - I
Summer Term 2017

Instructors:

Name	Section	Office	Email
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Text Book: *Microelectronic Circuits*, 7th Edition, A. Sedra and K. Smith, Oxford, 2015.

Laboratory Manual: *Electronics – I: Laboratory Manual*. （available in the cuLearn course website to students registered in this course）

Course Summary and Goals:

This is a first course covering semiconductor devices, their operation, and their application in simple analog electronic circuits. The material in chapters 1-7 of the text will be covered, including qualitative semiconductor physics leading to the diode equation, and diode circuit analysis. Bipolar and MOS transistors are introduced, including design of biasing circuits and small signal AC models. Design and analysis of operational amplifier circuits, and their use in simple active filters is studied.

Website:

See the course website on cuLearn periodically for information such as general announcements, problem assignments for PA sessions, TA office hours, pre-final marks etc.

Prerequisites:

Prerequisite for the course are listed in the undergraduate calendar and is ELEC 2501. Students without the prerequisite will be de-registered. Students with special requests may contact the course instructor, however, it is highly unlikely such requests will be entertained.

Course Organization:

The course consists of lectures, laboratory exercises and problem analyses (PA) sessions.

Marks:

Labs (5)	20%
PA - quizzes (4)	20%
Final Exam	60%

Note: To pass the course, all the following three conditions must be satisfied.

1) At least 4 of the 5 labs must be completed with final average lab marks of 50% or better to pass the course (all 5 labs will be counted while evaluating the lab-total).
2) At least 3 of the 4 quizzes must be completed with final average PA marks of 50% or better to pass the course (all 4 quizzes will be counted while evaluating the PA-total).
3) Final exam may differ from PAs in terms of complexity of questions and presentation of answers. At least 45% on the final exam is required to pass the course (final examination is for evaluation purposes only and the paper will not be returned or shown to the student).

LAB: Students work in groups of 2. Each group is required to maintain a laboratory notebook. All data, calculations, graphs etc., are to be recorded in the notebook, and as well, conclusions and discussions must be added at the end of each major part of the experiments. The notebooks will be collected at the end of each lab period, marked, and returned to you during your next-lab-turn (after one week).

LAB Exemptions: No longer accommodated.

PA: Problems for each week's PA sessions will be assigned and posted one week in advance on the ELEC 2507 course website. You are expected to work out these problems and self-evaluate yourself before coming to the PA. The PA sessions are to help with problem clarification, and to answer conceptual questions. Should you attempt all the assigned questions, the likelihood you would pass the quiz is higher. The last 45 minutes of the PA session are used to conduct a Quiz. The quizzes will be marked and returned during the next PA turn (after one week). Attendance will be taken at the beginning of the PA session and also a sign-up sheet will be passed to record the presence in the quiz.

Re-check: Requests for LAB report and PA quiz re-checks must be made to your respective TAs as soon as you receive them. Once you leave the LAB/PA room, you forfeit your right to ask for a re-check.

Missed Labs/PA/Quizzes: In such a case please contact the TA/PA, with-in 24 hours of the missed session, along with the medical certificate for making possible alternative arrangements.

Lecture Outline and Schedule: Following is the broad outline for the course and intended schedule for this term. Minor variations in it may be made by the instructor at the time of teaching and also depending on the circumstances and class schedules.

Lecture Outline

Lecture (week-wise)	Section(s) in Textbook (7th ed)	Content	Section(s) in Textbook (6th ed)
Week – 1	1.3 (summary) 2.1	Introduction to Analog Electronics: Devices, Circuits, Applications, Digital v/s Analog. Op-Amp Basics	1.3 (summary) 2.1
	2.1, 2.2, 2.3	Op-Amps: Basics, Inverting, Non-inverting Configurations, Buffer Circuit, Summing Circuit Amplifier Basics, Gain, Input/output Impedances, Buffer Circuits	2.1, 2.2, 2.3
	2.4	Difference Amplifier, Op-Amp Examples	2.4
	2.5	Integrator and Differentiator Circuits, Frequency Responses	2.5
Week – 2 (Lab1 – Basic circuit theorems, PA1 – no Quiz)	3.1 3.2, 3.3 3.4	Semiconductors – Intrinsic/Extrinsic Silicon Dopping – p, n, Diffusion/Drift Currents Diodes – Concepts of Physical Operation: p-n Junction Formulation	3.1 3.2, 3.3
	3.4-3.6	Barrier Potential, Forward Bias, Diode Current Equation, Reverse Bias, Examples	3.4-3.6
	4.1 4.2	Ideal Diode： Application in Logic Gates， Examples Characteristic Curves	4.1 4.2
	4.3	Modeling: Exponential Model, Graphical Analysis, Concepts of Load Line, Diode Simplified Models: Battery+Resistance Model, Constant Voltage Drop Model, Diode Small Signal Model, Examples	4.3

Week – 3 (Lab2- Op Amps, PA2 – Quiz)	4.4	Breakdown Characteristics – Zener Diode, Voltage Regulators	4.4
	4.5 4.6	Rectify circuits – HWR, FWR Analysis *Reading Assignment – Bridge Rectifier* Signal Processing Applications: Filter Circuits, Clippers and Clampers *Reading Assignment –- Special Types of Diodes: Varactor, LEDs*	4.5 4.6
	6.1-6.2	Bipolar Junction Transistors – Basics, Symbols and Conventions, Modes of Operation, NPN - Active Mode, Current Relations, Examples, BJT Characteristics, Early Effect *Reading Assignment – PNP transistor*	6.1-6.2
		D. C. Circuit Analysis, Fixed Bias, Voltage Divider Bias, Collector Feedback Bias, Examples	6.3
Week – 4 (Lab3- Diodes PA3 –Quiz)	7.1	BJT as an Amplifier, Graphical Analysis, Transistor as an Amplifier, Examples *Reading Assignment – BJT as a switch*	6.4
	7.2	BJT Small Signal Models, Examples	6.5
	7.3	Single Stage BJT Amplifiers, Common Emitter Amplifier, Examples, BJT-CB, CC Amplifier Analysis	6.6
	5.1	FET - Basics, Comparison: BJT v/s FET, Types, n/p Channel, Construction, *Reading Assignment – p-MOS, CMOS*	5.1
Week – 5 (Lab4 – BJT's PA4 –Quiz)	5.2	n-channel MOSFET – Operation as V_{DS} increased, Characteristics, MOSFET Regions of Operation, Current-Voltage Relationships, Early Effect,	5.2
	5.3	FET: D. C. Analysis; Examples,	5.3

	7.1	MOSFET as an Amplifier, Transfer Characteristics, Examples *Reading Assignment – MOSFET as a Switch*	5.4
	7.2, 7.3	FET – Small Signal Operation, MOSFET Amplifier Configurations: CS, CG, CD	5.5, 5.6
Week–6,7 (Lab5 - MOSFETs PA5 - Quiz)	7.4	FET – Current Source Biasing	5.7
	7.5	FET – CS Amplifier Analysis	5.8
	5.4	FET – Body Effect, CG, CD Amplifier Analysis	5.8,5.9
	review	Op-Amps, Diodes, BJT, MOSFET	review