Dordt College Engineering Department
EGR 204, Introduction to Microprocessors and Digital Circuits

Fall 2019 Syllabus

This syllabus is entirely BOGUS! It is a place holder and will be replaced before the course starts!

2018-19 Catalog Data:

EGR 323 Electronics II (4 credit hours) (Spring, odd calendar years)
A continuation of Engineering 322. Topics include biasing strategies for discrete and integrated circuit designs, current mirrors, differential and multistage amplifiers, frequency response, feedback, and stability. The laboratory includes construction of a kit, which introduces students to power output stages, tuned amplifiers, and demodulator circuits. The laboratory also includes a short design problem. Prerequisite: Engineering 322.

Textbook:

Sedra and Smith, *Microelectronic Circuits*, 7th ed., Oxford University Press, 2015.
(ISBN 978-0-19-933913-6)

References:

Horowitz and Hill, *The Art of Electronics*, 3rd ed., Cambridge University Press.

Tuinenga, Paul W., *SPCE: A Guide to Circuit Analysis and Simulation Using Pspice*, 3rd edition, Prentice Hall, 1995.

Instructor:

Professor Douglas De Boer, office location SB1638, office telephone 712-722-6245, e-mail: Douglas.DeBoer@Dordt.edu Prof. Office hours: 1 PM MWF or see http://dfdeboer.github.io.

Course Objectives and Outcomes:

Creational Structure: Students will be able to derive appropriate equations that model transistors, and know how to solve those equations.

Creational Development: Students will be able to apply several design techniques for stabilizing bias levels. They will be able to design amplifiers having one or two transistors in the signal path. This will be the main goal of this course.

Prerequisites by topic:

Calculus including techniques of integration, sequences, and series. Differential Equations. Linear circuit analysis including network theorems, first and second-order circuits, concepts in AC circuits such as frequency and phase, sinusoidal steady-state analysis and phasors. Solid state device physics at the level of equations that model the behavior of diodes and transistors, methods of amplification with single-transistor circuits.

Laboratory:

The laboratory session meets for three hours each week. See the schedule on the next page.

Computer use:

Orcad-Pspice is supported for circuit simulation. Students are encouraged (but not required) to use programs such as Matlab and/or Desmos for homework solutions when appropriate, especially for making graphs. All assignments and handouts are available via Dordt's "Canvas" course management system, https://dordt.instructure.com . An NCEES-approved calculator will be required for all tests and the final exam. See https://ncees.org/exams/calculator/

Academic Integrity:

This course is subject to the College's policies on academic integrity. (https://www.dordt.edu/student-life/student-handbook/general-information#Academic%20Integrity .) Also see the homework standards posted on the course web page and policies on the following pages of this syllabus.

Accommodations:

Students who require assistance or accommodations based on the impact of a documented disability must contact the Coordinator of Services for Students with Disabilities to access accommodations. Contact Marliss Van Der Zwaag at the Academic Enrichment Center, Telephone 722-6490, e-mail Marliss.VanDerZwaag@dordt.edu

Means of Evaluation:

Homework will be due on a weekly basis (10%), Two Tests (25% each), Formal Laboratory Report(s) due near the end of semester (15 %), Final Exam (25%) Professor De Boer records grades using grade points, A = 4.00, A– = 3.67, B+ = 3.33, B = 3.00, . . . D– = 0.67, F = 0.00. See https://dfdeboer.github.io/GDS.HTM for full details.

Role of this Course

This course is taught at the junior/senior level. It is intended for engineering and computer science majors. It is required for engineering majors who select the electrical or computer concentration.

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Course Outline

Dates			Class Meets MWF 12:00 to 12:50 PM in room SB2803	Laboratory Meets Wednesdays 2-5 PM in room SB2803
	1/16	1/18	Introduction: IC design issues, 1 + 1 = 3 idea, FET and BJT current mirrors *Text: Chapter 8*	(no lab this week)
1/21	1/23	1/25	Intrinsic gain, cascode amplifier, Darlington, Sziklai pairs, class B and class AB amplifiers *Text: Chapters 8, portions of Chapter 12*	Logic Gates
1/28	1/30	2/01	Wilson, Widlar current mirrors and other variations *Text: Chapter 8*	Class B and C amplifiers
2/04	2/06	2/08	Differential amplifiers and common-mode rejection *Text: Chapters 9*	AM/FM radio project, AF section
2/11	2/13		MOSFET and BJT differential amplifiers, active loads *Text: Chapter 9*	AM/FM radio project, AM detector, IF
2/18	**2/20**	2/22	Second-order differential amplifier issues: DC offsets, slew rate, multistage differential amplifiers *Text: Chapter 9* **Test #1 on Wednesday**	AM/FM radio project, AM mixer, RF section and alignment
2/25	2/27	3/01	Review of sinusoidal steady-state analysis *Text: Appendix F (see also your EGR 220 text)*	Amplifier design project, 1st of 4 weeks
3/04	3/06	3/08	Poles, zeros, bode plots in magnitude and phase *Text: Appendix F (see also your EGR 220 text)*	Amplifier design project, 2nd of 4 weeks
	3/20	3/22	High frequency models for MOSFETs and BJTs *Text: Chapter 10*	Amplifier design project, 3rd of 4 weeks
3/25	3/27	3/29	High frequency response of CS, CE amplifiers Estimating the effects of non-dominant poles *Text: Chapter 10*	Amplifier design project, 4th of 4 weeks
4/01	4/03	4/05	High frequency response of CG, CB, Cascode amps *Text: Chapter 10*	AM/FM radio project, FM detector and IF
4/08	**4/10**	4/12	High frequency response of CD, CS and diff amps *Text: Chapter 10* **Test #2 on Wednesday**	AM/FM radio project, FM mixer, RF
4/15	4/17	4/19	Feedback: Four configurations. *Text: Chapter 11*	AM/FM radio project, FM alignment
4/22	**4/24**	4/26	Voltage feedback amplifiers, other configurations *Text Chapter 11* **Lab report due on Wednesday**	AM/FM radio project, extra week for catch-up
4/29	5/01	5/03	Feedback and stability *Text Chapter 11*	Network analyzer demo
Wednesday, 5/08			**Final exam on Wednesday, 10:30 a.m. – 12:30 p.m.**	

This schedule may vary up to two weeks in order to accommodate student interests and abilities.

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Some of the information on this and the following pages is copied from the Student Handbook as per policy in Dordt College's "Syllabus Checklist." Additional information specific to this course (not in the Student Handbook) is in a serif typeface and has a black line down the left margin.

Academic Integrity

Dordt College is committed to developing a community of Christian scholars where all members accept the responsibility of practicing personal and academic integrity in obedience to biblical teaching. For students, this means not lying, cheating, or stealing others' work to gain academic advantage; it also means opposing academic dishonesty.

Academic Dishonesty. Students found to be academically dishonest will receive academic sanctions from their professor (from a failing grade on the particular academic task to a failing grade in the course), who will report the incident and the sanction given to the Student Life Committee for possible institutional sanctions (from a warning to dismissal from the college).

Appeals in such matters will be handled by the student disciplinary process as outlined in the Student Handbook.

Definitions

Academic dishonesty at Dordt College includes, but is not limited to, the following behaviors:

Stealing/Plagiarizing: copying another's work or ideas and creating the impression that they are one's own by failing to give proper credit or citation. This includes reading or hearing another's work or ideas and using them as one's own; quoting, paraphrasing, or condensing another's work without giving proper credit; purchasing or receiving another's work and using, handling, or submitting it as one's own work.

Cheating: unauthorized use of any study aids, equipment, or another's work during an academic task. This includes using unauthorized aids or other equipment during an examination; copying or looking at another individual's examination; taking or passing information to another individual during or after an examination; taking an examination for another individual; allowing another individual to take one's examination; stealing examinations.

All graded academic tasks are expected to be performed on an individual basis unless otherwise stated by the instructor.

An academic task may not be submitted by a student for course credit in more than one course without the permission of all instructors.

Lying/Fabricating: the intentional, unauthorized falsification or invention of any information or citation during an academic task. This includes changing or adding an answer on an examination and resubmitting it to change the grade; inventing data for a laboratory exercise or report.

Facilitating Academic Dishonesty: knowingly allowing or helping another individual to plagiarize, cheat, or fabricate information.

Students must do their own work. In Prof. De Boer's courses students may verbally discuss homework but may not show un-graded papers to each other. Detail on this policy can be found on the web at https://dfdeboer.github.io/S19/HWSTDS19.HTM#DYOW This policy applies to the whole course, not just homework.

Attendance

Students are expected to be present for every class and laboratory period. Penalties for absence from class are left to the instructor. No designated number of skips is permitted.

Student Responsibility: Students shall notify each professor concerning the reason for absence prior to or immediately upon returning to class or in accordance with the instructor's method of accounting for absences. Students shall notify student services concerning all illnesses.

Unexcused absences are defined as failing to notify the instructor of the reason for the absence, or if the instructor deems the reason as illegitimate.

Faculty initiatives: The instructor may contact student services to check on the illness record of the students. They should also alert student services and contact the student directly concerning excessive absences, and must, if asked, report attendance patterns. Any instructor may, after due warning and according to guidelines established in the class syllabus, penalize the student by reducing the semester grade by a given percentage.

Student Services Responsibility: Normally, student services does not notify instructors concerning

student illness. Student services may alert instructors to serious problems. Decisions to inform instructors about serious problems will be made balancing the need to respect confidentiality and the responsibility to keep instructors appropriately informed about their students. Any student with serious problems is strongly advised to work closely with student services and follow the process to insure adequate communication between all parties in as efficient a way as possible.

Excused Absence for Activities: Students have obligations in many realms, so special care shall be taken not to demand commitments for participation in extra-curricular events that cause neglect in other areas. Sponsors/coaches shall inform students from the beginning of the time and effort expected of them. Sponsors/coaches shall demand a minimum of absences from other classes, restrict student involvement to only those crucially involved, and make efforts to choose a time/date for the event that is least invasive of classroom or lab time. In the case of conflicts, resolution shall be the responsibility of the sponsor/coach and the instructor with no penalty to the student (The appeals process outlined in the section titled Complaints Regarding Instruction in the Student Handbook shall be used if needed). The sponsor shall email faculty and student services a list of names, dates, and activities in advance of the event. The student must contact the instructor and make arrangements for any missed work.

Professor De Boer expects to be notified at least a day in advance when you can reasonably be expected to have known that far in advance of a time when you will have to miss a class for a scheduled event of higher priority. In addition to the options listed above, missing classes without notification or for insubstantial reasons could be cause for being classified as an "uncooperative student" which could lead to dismissal from the course.

Late work

Be coachable. Start work early so you can ask questions in class and at the Professor's office. Anything handed in late will be accepted for possible grading, but no grade will be entered in the grade book, the work will not be returned to you, and the empty grade will function as a zero or an "F." Usually the item will never be graded. If, in the judgment of Prof. De Boer, grading the late item might improve the course grade, and if the reasons for the late work are acceptable and if there is no pattern of carelessness, then Prof. De Boer may choose to estimate a grade or actually grade the late work and enter the grade(s) in the grade book. Prof. De Boer may make a decision to estimate or fully grade a late item at any time after the item is handed in, but usually will do so only at the end of the course after all student course activities are complete. Additionally, if a pattern of late work develops, Professor De Boer will warn the student. After that warning if the problem is not resolved, a reduced course grade might result and/or the student may be classified as "uncooperative" which could lead to dismissal from the course.

Missed tests or exams

Professor De Boer announces his test schedule in the first week of classes. During the first two or three weeks of classes and possibly at other times, if there is good cause, students may negotiate to change the test date(s) for the entire class to avoid a conflict for any one student. However in the week before a test Prof. De Boer is very reluctant to negotiate the date. If you realize that you have a schedule conflict with a test date, discuss this with Prof. De Boer as soon as possible.

If you are late to a test you must still finish at the scheduled time.

If you miss a test or exam entirely the test or exam will go in the grade book as a blank score which will count as an "F." At the end of the semester after all your course work is complete Prof. De Boer will reassess the situation and might choose to estimate what he thinks you might have earned on the test based on any evidence he can find relevant to the situation. If an estimated grade is granted, it may still be discounted to a lower grade than the other tests and exams you completed if negligence is a partial cause for missing the exam. A dead cell phone battery that causes you to miss an alarm is an example of negligence. If a test is missed due to illness (fever, nausea, etc., not just a "bad cold") then be sure to report the illness to student services before the test or during the test period or as early as is reasonable. If student services can verify your illness to Prof. De Boer, an estimated grade that is non-punitive will be given at the end of the semester.

Class Participation

Professor De Boer does not grade class participation—it is expected. If your participation is a problem Prof. De Boer will talk about it privately with you. Lack of participation can be a cause for adjusting your course grade downward, even to an "F."

Description of assignments

Homework: Generally a homework assignment will be due once each week. Expect the assignment to take about six hours to finish. Expect to have to ask for help to finish it. Make use

of office hours or e-mail, or make telephone calls to the professor to get help as you need it.

Tests: Two tests and a final exam will be given. The first test is closed-book, but a crib sheet is allowed. The other test and the final exam are open book.

Lab Report. The lab is a time for conversation and exploration. Much of what is done there involves kinesthetic and judgmental skills in using the instrumentation well, laying out prototype circuits, and interpreting observations. Situations for each student vary tremendously depending on a multiplicity of factors. It is not efficient to rely on grading as your feedback for learning in the lab. Therefore, ask questions and show your results to professor De Boer as things happen. Get your feedback in real time, with no implications for your grade. Be coachable. In the lab you will spend about eight weeks doing exercises that will prepare you for a project. Then you will have about three weeks to do a project to demonstrate what you have learned in the earlier lab exercises and in class. You will turn in a lab report on the project. The lab portion of your course grade will depend entirely on the report. The report will be graded for style, completeness, and accuracy.