Dordt University, Engineering Department
EGR 204, Introduction to Microprocessors and Digital Circuits
Fall 2019

2019–20 Catalog Description	**Introduction to Microprocessors and Digital Logic (4 credit hours)** (Fall Odd) Digital circuits are covered, from simple logic gates through elementary microprocessor architecture. The course begins with elementary logic for binary systems, Boolean algebra, binary integer number formats and arithmetic and combinational design. Intermediate topics include synchronous state machine design and register level concepts. The course concludes with topics in microprocessor architecture that include elementary assembly language and interfacing. Laboratory provides hands-on experience in logic design and microprocessor interfacing and includes two formal design projects. This course serves both computer science and engineering students. Prerequisite: Engineering 117 or Physics 202 or Physics 216. (4 credit hours)
Textbook	M. Morris. Mano and Charles R Kime, *Logic and Computer Design Fundamentals*, 5th edition, Pearson, 2016. ISBN 978-0-13-376063-7
References	Hayes, *Introduction to Digital Logic Design*, Addison Wesley Bartee, Thomas C., *Digital Computer Fundamentals*, McGraw-Hill.
Instructor	Douglas F. De Boer, Professor of Engineering, https://dfdeboer.github.io/ Office Phone: 712-722-6245; Office location: SB1638 Office hours 9:25 – 10:40 AM Tu/Th or see my homepage (URL two lines above) for more info. E-mail Douglas.DeBoer@Dordt.edu, Home Phone: 722-1414, please call before 10 PM.
Course Objectives and Outcomes	*Creational Structure:* Students will understand the laws of logic needed for designing digital circuits. *Creational Development:* Students will be able to use basic laboratory equipment such as power supplies, logic probes, and logic simulators as tools for analysis. They will design and demonstrate combinational and sequential circuits with limited numbers (about 4) of inputs, outputs and state variables. They will test circuits that interface to a microprocessor. They will be able to use an integrated development environment (IDE) to test prototype digital circuits.
Prerequisites by topic	Introductory DC circuits as presented in typical high-school physics classes, high-school algebra, and freshman university level problem solving skills in a science or engineering context.
Laboratory	One three-hour lab session per week, Mondays at 2–5 PM. See schedule on next page.
Computer Use	An integrated development environment (IDE) is a central feature of the lab (Altera's Quartus Prime). Students write and run short machine language programs. Assembly of code is done by hand. 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 Dordt University'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 Canvas 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 (10%), Two Tests (24% each), Final Exam (27%), Lab (Two reports, ~7.5% each). Professor De Boer grades using *grade points* on a scale from 4.00 to 0.00. Nominally, 4.00–3.75 =A, 3.7–3.45 = A–, 3.44–3.15 = B+, 3.14–2.85 = B, 2.84–2.50 = B–, 2.49–2.14 = C+, etc. Details at "Professor De Boer's Method of Grading" at https://dfdeboer.github.io/GDS.HTM
Role of this Course	This course is taught at the freshman/sophomore level, although it is normal for students to delay this course into their junior or even senior years. It is required for students in the electrical concentration of the engineering major.

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Class meets for two 75-minute periods per week, Tuesdays & Thursdays at, 8:00 – 9:50 AM in room SB2803
Lab meets for one 3-hour meeting per week, Mondays in Room SB2803, 2:00 to 5:00 PM

Dates			Class	Laboratory
	8/27	8/29	Introduction, Binary Numbers and Codes Text Chapter 1, Sections 1-1, 1-2, 1-3, 1-6, 1-7	No lab this week (First week of class)
9/02L	9/03	9/05	Logic Gates, Boolean Algebra Text: Chapter 2, Sections 2-1 thru 2-3	1.) Safety and Introduction. to the Equipment
9/09L	9/10	9/12	Karnaugh Maps, Sufficient Sets of Gates Text: Chapter 2, Sections 2-4 to the end	2.) DeMorgan's Theorems and Logic Simplification
9/16L	9/17	9/19	Combinational logic, HDL & Simulation Text: Chapter 3, Sections 3-1 thru 3-6.	3.) Introduction to hierarchical design and VHDL
9/23L	9/24	**9/26**	Combinational Functions—Nonarithmetic Text, Chapter 3., Sections 3-7 thru 3-8 **Test #1 Thursday, 9/26**	4a.) Combinational Logic Design Project & Programmable Logic
9/30L No class on Thursday	10/01		Combinational Functions—Arithmetic Text: Chapter 3, Section 3-9	4b.) Design Project (2nd wk)
10/07L	10/08	10/10	Combinational Functions—Arithmetic Text: Ch. 1 Sec 1-3, 4 and Ch 3 Sec. 10 to end	4c.) Design Project (3rd wk)
10/14L	10/15	10/17	Latches and Flip-Flops Text: Chapter 4, Sections 4-1 thru 4-3	5.) Binary Arithmetic and Combinational Logic Functions
10/21L	10/22	10/24	State Machines Text: Chapter 4, Secs. 4-4 t end, omitting 4.8.	7.) Introduction to Flip-Flops
10/28L	10/29	**10/31**	Registers Text: Chapter 6, omit Section 6-12 **Test #2 Thursday, 10/31**	8a.) Synchronous State Machine Design (1st of 3 weeks)
11/04L	11/05	11/07	Memory and Programmable Logic Text Chapter 7	8b.) Synchronous State Machine Design (2nd wk)
11/11L	11/12	11/14	CPU and Microprocessor Basics Text Chapter 8	8c.) Synchronous State Machine Design (3rd wk)
11/18L	11/19	11/21	Assembly Language Text Chapters 9, 10	9.) ALU Design
11/25L No class on Thursday	11/26		I/O and Communication Text Chapter 11	10) Datapath Design
No Lab on Monday	12/03	12/05	Review or catch-up	(Thanksgiving Break)
12/09L No class on Thursday	12/10		Review or catch-up	11.) Control Unit Design
12/16			**Final Exam** **Monday, 12/16 10:30 a.m. – 12:30 p.m.**	

The class and laboratory schedules may vary by up to two weeks to accommodate the pace of this particular group of students. This could require the deletion or addition of a corresponding amount of course content.

Some of the information on this and the following pages is copied from the Student Handbook as per policy in Dordt University'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 University 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 university).

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

Definitions

Academic dishonesty at Dordt University 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, by telephone, by e-mail, 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 decide to estimate or fully grade a late item at any time after the item is handed in, but usually will do so 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.

(continues on next page)

Missed tests, quizzes, exams or other in-class items that are graded

Professor De Boer announces his test schedule and major due dates for projects 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 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 or other due date, discuss this with Prof. De Boer as soon as possible.

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

When an in-class item is missed entirely due to unplanned absence from the classroom Professor De Boer does not give a make-up test or offer extra credit work or similar. If you miss an in-class event entirely (such as a test) the item 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 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 items you completed if negligence is a factor. A cell phone alarm accidentally set to PM instead of AM that causes you to miss an exam 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, Professionalism

Professor De Boer does not routinely grade class participation or professionalism. These are expected. If there is a problem, Prof. De Boer will talk about it privately with you. Lack of these can be a cause for adjusting your course grade downward, even to an "F," but if Professor De Boer has not discussed these matters privately with you, you can assume you are doing well enough that your course grade will not be adjusted due to these matters.

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

Projects. Some lab time will be available for projects. Much of what is done there involves kinesthetic and judgmental skills in using the equipment 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 only feedback for learning in the laboratory. Therefore, ask questions of professor De Boer as things happen. Get your feedback in real time, with no implications for your grade. The actual physical work you do in the laboratory will not be graded, but it will be the foundation for a report that will be graded. You should use the laboratory time as an opportunity to be coached. (Be Coachable.)

Your project grades will depend entirely on your project reports. Write your reports in ASME or IEEE style. The reports will be graded for style, completeness, and accuracy as described in the pamphlet "How to Write a Laboratory Report" which you will be provided to you.

(end of EGR 204 syllabus)