CASE WESTERN RESERVE UNIVERSITY
Case School of Engineering
Department of Electrical, Computer and Systems Engineering

ECSE 281 / CSDS 281 Logic Design and Computer Organization (4)
Spring 2024 Course Information

Summary Description:

Fundamentals of digital systems in terms of both computer organization and logic level design. Organization of digital computers; information representation; Boolean algebra; analysis and synthesis of combinational and sequential circuits; datapaths and register transfers; instruction sets and assembly language; input/output and communication; memory.

Prerequisites:

ENGR 131 or ECSE 132/CSDS 132 (previously EECS 132) or ENGR 130 (previously ENGR 131B)

Textbook:

Digital Design Practice & Principles, Fifth Edition, 2018, John F. Wakerly, Pearson. ISBN-13: 9780134460093

Lecture Schedule:

TuTh 10:00 - 11:15 AM, Millis Schmitt Lecture Hall

Laboratory / Recitation Schedule:

Tu 1:00PM - 1:50PM, Nursing Research Building G25

We 10:35AM - 11:25AM, Rockefeller 309

We 11:40AM - 12:30PM, Nord Hall 410

Instructor:

Assoc. Prof. Evren Gurkan-Cavusoglu

Email: exg44@case.edu

Office: Olin 706

Phone: 368 4463

Instructor Office Hours: see course Canvas site

Teaching Assistants:

Teaching Assistants' (TAs) contact information and TA office hours will be posted on the course Canvas site.

Course Material:

All required course information and materials will be posted on the course Canvas site.

Basis of Grades:

Homework (30%):

About one assignment per week, which will be typically posted on Thursday afternoons and collected on the following Thursday on Canvas. Assignments will include problems and CAD laboratories. A **single pdf file** with problem solutions and the lab part should be uploaded to Canvas.

Exams:

Mid-term 1, February 27 (20%), Mid-term 2, April 9 (20%), Final, May 9 Thursday 8:00AM – 11:00AM (30%). Calculators are not allowed on the exams.

Late Policy:

Assignments are due on Canvas on the specified date. Late work will NOT be accepted. Make-up exams are DISCOURAGED and are only allowed when prior approval is obtained from the instructor.

Homework Grades:

The homework grades will be posted on Canvas the week following the homework submission. It is your responsibility to make sure that the posted grade is correct. You can object and correct your grade within one week from the posting on Canvas. No future objections will be accepted beyond that one week period.

Recitation / Laboratory:

Recitations will be used to 1) introduce laboratories, and 2) reinforce lecture material by working example problems. Recitation sections are 50 minutes in duration and will be held three times per week, as per the Registrar's class schedule.

The recitation sections in the Spring 2024 semester are:

Tu 1:00PM - 1:50PM, Nursing Research Building G25

We 10:35AM - 11:25AM, Rockefeller 309

We 11:40AM - 12:30PM, Nord Hall 410

Laboratory assignments will be given as your weekly homework and will emphasize the use of computer simulation tools. For logic design and simulation, ModelSim (release 20.1.1) will be used. You will need to download a free version of ModelSim at: **ModelSim download link**

When you connect to the download link given above, it will take you to Quartus Prime Lite Edition page. On this page, please make sure that the version appears as follows:

Version: 20.1.1

You will then need to scroll down the page up to Downloads. Under the Downloads heading, select Individual Files tab to reach the link for downloading ModelSim-Intel FPGA Edition (includes Starter Edition).

ModelSim is not available for Mac users. In that case, please access the software through **myapps.case.edu** remotely. Please make sure to save your work on H drive when using myapps.case.edu.

For microprocessor programming and simulation, MPLAB, a public-domain simulator for the Microchip PIC microcontroller, will be used.

The MPLAB software is public domain and may be downloaded from Microchip website. You need to download MPLAB X IDE. You do not need the MPLAB® XC: Compiler for this course. You need to install an older version of MPLabX that has mpasm compiler (e.g. v3.45 or 5.15). You can download v3.45 (or 5.15) from the following link: MPLABX download link for a previous version with mpasm

The software is also available to be used remotely on myapps.case.edu.

You will need to download the MPLAB IDE User's Guide

The introductory article by M. Covington, "PIC Assembly Language for the Complete Beginner", and the "PIC16F84A Data Sheet" , will serve as primary classroom references for the PIC microcontroller.

Both ModelSim and MPLAB are available through **myapps.case.edu**. Please make sure to save your work on H drive when using myapps.case.edu.

Academic Integrity:

Case Western Reserve University academic integrity policies apply.

AI Policy For ECSE 281/CSDS 281:

You may not engage in unauthorized collaboration or make use of AI composition software (such as ChatGPT) in this course. Using these tools puts your academic integrity at risk.

Spring 2024 Agenda (with tentative homework due dates)

Class	Date	Topic	Reference[1]
		I. Binary Number Systems	
1	1/16	Introduction	
2	1/18	Positional number systems, octal/hex numbers	2.1-3
3	1/23	Binary addition/subtraction, signed numbers	2.4-5
4	1/25	Signed numbers, 2's complement add/sub	2.5-6
		II. Boolean Logic Circuits and Families	
5	1/30	Logic signals and gates	1.4, 1.5, 1.8, 1.9
6	2/1	Logic families, CMOS logic, switching algebra	14.1, 3.1
		III. Principles of Combinational Logic Design	
7	2/6	Switching algebra	3.1
8	2/8	Combinational circuit analysis	3.1.6, 3.2
9	2/13	Combinational circuit synthesis, description and design, adders, ripple adders	3.3.1-3, 8.1.1-2
		IV. Practices in Combinational Logic Design	
10	2/15	Combinational circuit minimization	3.3.4
11	2/20	Timing hazards, circuit timing, decoders	3.4, 4.2, 6.3
12	2/22	Binary decoder	6.3
13	2/27	**Mid-term Exam 1**	
14	2/29	Encoders, multiplexers	6.3.7, 6.4, 7.2
15	3/5	Multiplexers, exclusive-or, comparators, three-state devices, state machine basics, bistable elements	6.4, 7.3-4, 7.1, 9.1, 10.1
		V. Principles of Sequential Logic Design	
16	3/7	Latches and flip-flops	10.2
	3/12, 3/14	**NO CLASS** – Spring Break	
17	3/19	Designing synchronous circuits using state machine	9.2
18	3/21	State machine design, state diagram	9.3
		VI. Practices of Sequential Logic Design and Memory	
19	3/26	Switch debouncing, registers, counters	10.4-5, 11.1.1
20	3/28	Counters, example of sequential logic design (tbird)	11.1.2-3, 9.4
21	4/2	Shift registers, synchronous design impediments, ROM	11.2.1-3, 13.3.1-3, 6.1, 15.1.1-5
22	4/4	RWM, static RAM, PIC overview	15.2, 15.3.1-3, 15.4.1
23	4/9	**Mid-term Exam 2**	
		VII. Microprocessor Architecture	
24	4/11	PIC overview and memory, the PIC instruction set	Covington[2], Section 1.0, 2.0, 4.0, 7.0[3]
		VIII. Assembly Language Programming	
25	4/16	Assembly language – a first program (turnon.asm), bit rotation with delay (chaser.asm)	
26	4/18	Bit rotation with delay (chaser.asm), bit manipulation (adder.asm)	
27	4/23	Bit manipulation (adder.asm)	
28	4/25	PIC i/o and macros – state machines using if-else logic (tbird.asm), state machine using PIC (guessing game) overview, review	12.7
	5/9	**Final Exam**	

[1] section numbers are taken from primary textbook by Wakerly, 5th ed.

[2] M. Covington, "PIC Assembly Language for the Complete Beginner"

[3] PIC16F84A Data Sheet