Course Syllabus

CP220/PC220: Digital Electronics
Physics and Computer Science Department, Faculty of Science, Waterloo Campus
FALL | 2024

Instructor Information

Name: Dr. Maher Ahmed | Office Location N2076B
Contact Information: email mahmed@wlu.ca
Weekly Office Hours: by Appointment

Lab Instructors

Name: Mr. Terry Sturtevant
Contact Information: Email tsturtevant@wlu.ca
Weekly Office Hours: by Appointment

Name: Dr. Shaun Gao
Contact Information: Email lgao@wlu.ca
Weekly Office Hours: by Appointment

Name: Dr. Sumeet Kaur Sehra
Contact Information: Email sksehra@wlu.ca
Weekly Office Hours: by Appointment

Course Information

Course Overview

CP220/PC220
Digital Electronics
0.5 Credit

Hours per week:

- Lecture/Discussion: 3
- Lab: 1.5

Introduction to digital logic: logic gates, combinational circuit analysis using Boolean algebra and Karnaugh maps, number systems and codes, minimization techniques applied to combinational logic systems; flip-flops, multivibrators, counters, and shift registers. (Cross-listed as PC220.)

Additional Course Information

Prerequisites

CP164 and registration in Computer Science.

Exclusions

CP120/PC120.

Course Outlines

- 1. Digital Concepts.
- 2. Number Systems, Operations, and Codes.
- 3. Logic Gates.
- 4. Boolean Algebra and Logic Simplification.
- 5. Combinational Logic Analysis.
- 6. Functions of Combinational Logic.
- 7. Latches, Flip-Flops, and Timers.
- 8. Shift Registers.
- 9. Counters.

Course location, meeting times and days

Digital Electronics	220	A	Maher Ahmed (Primary)	Monday,Wednesday
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				S
				02:30 PM - 03:50 PM
				Type: Class **Building:** Arts Building **Room:** 1E1 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	B	Maher Ahmed (Primary)	Tuesday,Thursday
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				05:30 PM - 06:50 PM
				Type: Class **Building:** Lazaridis Hall **Room:** LH3094 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L1	Shaun Gao (Primary)	Monday
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				11:30 AM - 12:50 PM
				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L10	Terrance Sturtevant (Primary)	Thursday
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				04:00 PM - 05:20 PM
				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L11	Shaun Gao	Wednesday
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				10:00 AM - 11:20 AM
				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L12	Terrance Sturtevant (Primary)	Thursday
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				02:30 PM - 03:50 PM
				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L13	Terrance Sturtevant (Primary)	Friday
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				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L14	Terrance Sturtevant (Primary)	Friday
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				01:00 PM - 02:20 PM
				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L15	Shaun Gao (Primary)	Thursday
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				11:30 AM - 12:50 PM
				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L16	Shaun Gao (Primary)	Tuesday
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				11:30 AM - 12:50 PM
				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L17	Terrance Sturtevant (Primary)	Thursday
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				01:00 PM - 02:20 PM
				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L18	Sumeet Kaur Sehra (Primary)	Tuesday
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				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L2	Shaun Gao (Primary)	Monday
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				01:00 PM - 02:20 PM
				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L22	Sumeet Kaur Sehra (Primary)	Monday
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				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L23	Shaun Gao (Primary)	Tuesday
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				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L24	Terrance Sturtevant (Primary)	Monday
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				10:00 AM - 11:20 AM
				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L26	Shaun Gao (Primary)	Tuesday
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				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L27	Shaun Gao (Primary)	Thursday
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				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L28	Shaun Gao (Primary)	Thursday
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				10:00 AM - 11:20 AM
				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L29	Sumeet Kaur Sehra (Primary)	None
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				Type: Class **Building:** None **Room:** None **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L3	Terrance Sturtevant (Primary)	Monday
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				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L34	Shaun Gao (Primary)	Wednesday
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				05:30 PM - 06:50 PM
				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L4	Terrance Sturtevant (Primary)	Tuesday
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				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L5	Terrance Sturtevant (Primary)	Tuesday S M T W R F S 02:30 PM - 03:50 PM **Type:** Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L6	Shaun Gao (Primary)	Wednesday S M T W R F S 11:30 AM - 12:50 PM **Type:** Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L7	Shaun Gao (Primary)	Wednesday S M T W R F S 01:00 PM - 02:20 PM **Type:** Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L8	Shaun Gao (Primary)	Wednesday S M T W R F S 04:00 PM - 05:20 PM **Type:** Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L9	Terrance Sturtevant (Primary)	Tuesday S M T W R F S 04:00 PM - 05:20 PM **Type:** Class **Building:** Science Building **Room:** N2083 **Start**

				Date: 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L22	Sumeet Kaur Sehra (Primary)	Monday S M T W R F S 07:00 PM - 08:20 PM **Type:** Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L23	Shaun Gao (Primary)	Tuesday S M T W R F S 07:00 PM - 08:20 PM **Type:** Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L24	Terrance Sturtevant (Primary)	Monday S M T W R F S 10:00 AM - 11:20 AM **Type:** Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L26	Shaun Gao (Primary)	Tuesday S M T W R F S 10:00 AM - 11:20 AM **Type:** Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L27	Shaun Gao (Primary)	Thursday S M T W R F S 07:00 PM - 08:20 PM **Type:** Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024

Digital Electronics	220	L28	Shaun Gao (Primary)	Thursday S M T W R F S 10:00 AM - 11:20 AM **Type:** Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L29	Sumeet Kaur Sehra (Primary)	None S M T W R F S - **Type:** Class **Building:** None **Room:** None **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L3	Terrance Sturtevant (Primary)	Monday S M T W R F S 04:00 PM - 05:20 PM **Type:** Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L34	Shaun Gao (Primary)	Wednesday S M T W R F S 05:30 PM - 06:50 PM **Type:** Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L4	Terrance Sturtevant (Primary)	Tuesday S M T W R F S 01:00 PM - 02:20 PM **Type:** Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital	220	L5	Terrance	Tuesday

Electronics			Sturtevant (Primary)	S
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				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L6	Shaun Gao (Primary)	Wednesday
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				11:30 AM - 12:50 PM
				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L7	Shaun Gao (Primary)	Wednesday
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				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L8	Shaun Gao (Primary)	Wednesday
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				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024
Digital Electronics	220	L9	Terrance Sturtevant (Primary)	Tuesday
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				Type: Class **Building:** Science Building **Room:** N2083 **Start Date:** 09/05/2024 **End Date:** 12/04/2024

Please note that: There are two web sites in my learning space one for the lectures and one for the labs.

For the labs:
Check with your lab advisor.

For the lectures:

- PowerPoints slides and other materials will be posted in my learning space under the news.
- Assignments will be posted in my learning space under quizzes.
- If you have questions, send these questions to me by e-mail at mahmed@wlu.ca and I will answer these questions in the lectures.
- You are welcome to make an appointment and meet with me in my office to answer any question.

Course Goals and Learning Outcomes

This is an introductory course in digital logic design that covers most of the fundamental skills involved in the analysis and design of digital circuits. Emphasis is on the gate level or higher, but not on the transistor level design. The course is expected to help the student:

1. Understand how different data items are represented in digital systems.
2. Understand the relevant theory behind the manipulation of binary data.
3. Use gates to represent actual real life applications.
4. Use different minimization techniques to achieve suitable implementation.
5. Use modules to build larger function blocks (e.g. adders, decoders).

Understand the basic components of microprocessors (e.g. registers, memory, ALU)

Course Textbook

Floyd "Digital Fundamentals", Eleventh edition, Pearson 2015

Tools and Learning Materials

Student Evaluation

Assessment	**Weighting**
Assignments/Quizzes	20%
Midterm exam	20%
Labs	20%
Final **Exam in-person**	40%
Total	**100%**

Please note that the department policy for 1st and 2nd year required courses, students must pass the final exam to pass the course.

If a student misses an assignment, he/she does not need to show the reason for missing it since the worst mark for the assignments will be dropped. However, if he/she missed more than one assignment he/she must show the reasons for missing all missed assignments.
If your final exam marks are better than the assignments marks, then I will drop your assignments marks, and your final exam marks weight will be 60%.
If you are repeating the course (and you passed the labs) you can keep the old lab marks. (however, let the lab advisor know what year and term you did the labs and make sure that we still have your old marks)
If you are repeating the course, you still must do the assignments and the midterm exam and the final exam.

Learning Activities, Assignments, Tests, Quizzes and Examinations

You will have an assignment approximately every week. The assignments will be posted in my learning space under quizzes.

The assignments will help you to understand the materials and to be ready for the exams.

The assignments and the examples that will be discussed during the lectures will help students to understand the materials and answer the questions in the exams.

Weekly Schedule(s) (lecture)

Week #	Topic, Theme or Unit of Study	Activities
Week 1.2 Week 3,4 Week 5,6 Week 7 Week 8,9 Week 10,11 Week 12	• Digital Concepts. • Number Systems, Operations, and Codes. • Logic Gates. • Boolean Algebra and Logic Simplification. • Combinational Logic Analysis. • Functions of Combinational Logic. • Latches, Flip-Flops, and Timers. • Shift Registers. • Counters. • Programmable Logic. Data Storage, review.	Assignments 1,2 Assignments 3,4 Assignments 5,6 Take-home Midterm exam Assignments 7,8 Assignments 9,10