ECE 376 - Embedded Systems

Fall 2026 - www.BisonAcademy.com

Course Information:

Instructor:	Jake Glower
Class Times	MWF 2pm, Offerdahl North 101
Lab Times:	Open Lab
Office:	Offerdahl Hall 244M & Zoom
Office Hours	Whenever I'm not in class
	MWF 8-10am, noon-2pm
	Tu/Th 8-9am,. 11am-4pm
Text:	www.BisonAcademy.com

Bulletin Description:

The use of microcontrollers for data acquisition and device control. Includes assembly language and high-level programming, serial and parallel I/O, timers and interface design. 3 lectures, 1 two-hour laboratory. Prereq: ECE 173, ECE 275, ECE 211. F, S

Course Objectives:

By the end of the semester, students should:

- Be able to solder a circuit board,
- Be able interface a microcontroller to binary inputs and outputs,
- Be able to interface a microcontroller to analog inputs and outputs,
- Be able to control these inputs and outputs using programs written in assembler and C, and
- Be able to use interrupts to control the precise timing of a microcontroller, precise to 100ns

Hy-Flex Model for Fall 2026

Students are welcome to take this course however they like:

- In-Person: Students are welcome to addend class at the designated class time and location.
- Live-Stream: Students are also welcome to live-steam the class. A link with how to connect will be sent out at the start of the semester on BlackBoard and to your NDSU email address.
- On-Line: Students are also welcome to take the class on-line and fit lectures into their own schedule.

Everyone is welcome to use the on-line resources on Bison Academy. These include

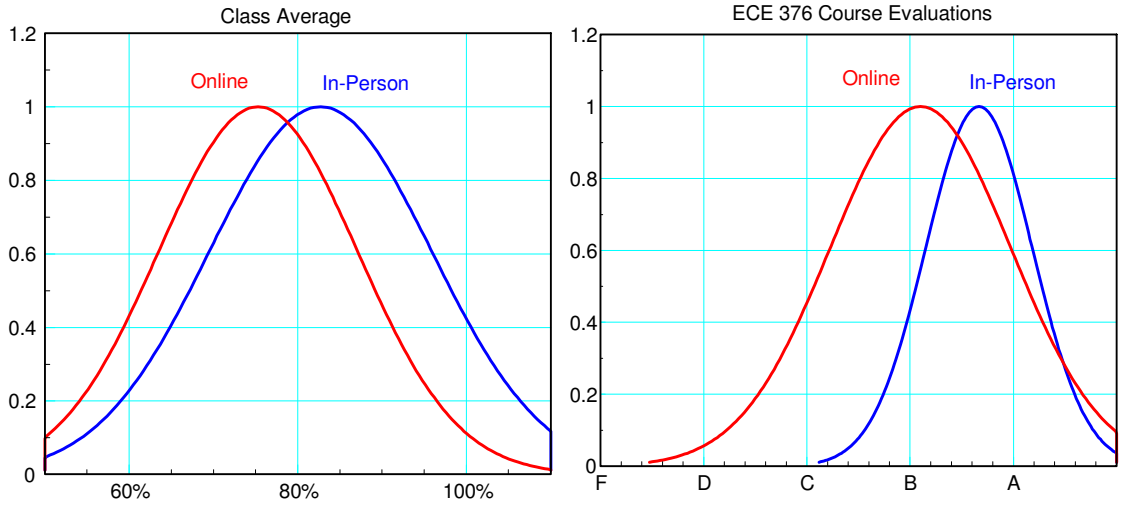
- Each day's lecture,
- Detailed lecture notes for each day,
- YouTube videos for each lecture,
- Sample code,
- Homework sets, and
- Solutions to previous homework sets (which are usually similar to this semester's homework)

In addition, midterms and the final will be offered both in-class as well as remotely through BlackBoard. If you opt for BlackBoard, you will typically be allowed to start any time between 8am and midnight the day of the test. Once you start the test on-line, you have 2 hours to complete the test, 3 hours to complete the final exam.

It's completely your choice how you take the class.

That being said, in-person is better than online. For Fall 2021, ECE 376 was offered both ways, like it is this semester. The end-of-the-semester course evaluations revealed that the students who took the course in-person rated the course a full-letter grade higher than those who took it via live stream or online:

Students who took the course in-person also had a higher overall class average than those who took it via live-stream of online: a full 7% higher on average.



Fall 2021 Results for ECE 376

This is a single data point and it may very well have sampling bias, but it does suggest that you'll get more out of the course if you take it in-peson than via live-stream or online.

Regardless, it's your choice how you take the class.

Evaluation Procedures and Grading Criteria

Grades will be the average of the following:

Midterms (x3)	Homework	Projects	Final Exam
50%	17%	17%	17%

Grades are rounded to the nearest 1%, with your final grade being

F	D	C	B	A
59% or less	60% - 69%	70% - 79%	80% - 89%	90% or more

How to Get an A or B: Keep up and do the homework. This class involves programming and interfacing hardware to your computer board. The only way I know to understand this interaction is to do it yourself. That's what the homework problems are for. It's also a building process. We start with getting an LED to blink and end up with controlling a DC servo motor with a keypad. If you fall behind, it will be hard to catch up. Besides, getting your board to do stuff like play the NDSU fight song on your speaker is what's fun about this course.

The grades in this class are often bimodal: people who did the homework themselves tend to get either an A or a B. People who did not do the homework or copied the struggle to get a D.

Dead PIC Board?

What to do if your board quits working: About half of the boards will quit working towards the end of the semester. If this happens to you, please see the instructor (Jake Glower). It's usually a bad solder connection which I can fix in 10-20 minutes. I also have left-over boards I can loan you while I repair your board. The course is a lot more fun if your board works - it also helps with completing the homework assignments.

Required Student Resources:

- Calculator capable of complex numbers
  Free42 app on your cell phone (free)
  HP Prime calculator ($140 from Amazon)
  Most ECE students use TI84 Plus ($100 from Amazon)
  Matlab also works
- ECE 376 Lab Kit - one kit per student (available from SWE for $65). You can also order your own parts (everything you need is posted on-line on Bison Academy). The cost for one kit is about $120 however. (SWE buys in bulk, saving you money.)
- Soldering Iron ($30 from Amazon - make sure it has auto-shutoff or sleep mode)
- Ability to make videos and preferably post them on YouTube.

Homework & Lab Projects

Each student can work in a group of 1 or 2 (max). Only one homework set / term project is required per group. Note, however, that the first exam (and perhaps others) will have two parts

- A written portion, and
- A lab portion where you work along to get a program to compile, download, and run.

Likewise, please make sure that you understand how the hardware and software works for each homework set.

Most homework sets are open-ended: you are free to specify what it is you're going to build and program (subject to it including things that we're covering that week, such as stepper motors). Each write-up includes five sections:

- Requirements What your device does and the requirements it needs to meet.
- Analysis : What a typical midterm is. Schematics and calculations for the resistors, capacitors, transistor gains, etc.
- Software: Flow charts and description of how your code works and incorporated features covered in class,
- Verification: Collect data to verify your design works or mostly works. (Loop times, voltages, currents, etc.)
- Demonstration: In-person or YouTube video presentation: showing off and explaining your design.

Note that if you use trial-and-error design to get a working device, you'll probably be spending 20+ hours/week in lab and will struggle to get a C. Conversely, if you understand the design, can verify your analysis with lab data, and it just refuses to work, you still get an A. As engineering students, the important part of your design is your understanding of how it works and ability to verify your analysis.

Use of AI & ChatGPT

AI exists. ChatGPT exists. If you get stuck on a homework set or want to learn new commands and new tricks, ChatGPT and AI are useful tools to use. Please do *not* turn in code written by either, however.

AI and ChatGPT works by searching the web for similar problems then copies their solutions. That doesn't work in this course.

- ECE 376 focuses on low-level programming at the register level. The processor we're using, the PIC18F4620, has a unique set of registers. AI doesn't know that.
- The PIC evaluation board you're building and using in this course has a unique set of connections to the push buttons, LCD display, etc. AI doesn't know that either.

ChatGPT and AI tend to give solutions that are partly correct and partly pure nonsense. If you turn in a solution that's pure nonsense, I'll assume you don't understand what you're doing and grade accordingly.

This is part of the reason that part of each homework set is to have you build and demonstrate a working embedded system. In order to get your code and hardware to work, you kind of have to understand how it works.

Plus, it makes the course a whole lot more fun. The reason you go into engineering is you want to build things. This course is were you get to do that.

Legal Stuff:

Attendance: According to NDSU Policy 333 (www.ndsu.edu/fileadmin/policy/333.pdf), attendance in classes is expected. Students are responsible for the material covered in class and in assignments regardless of their attendance. Note that all lecture notes, homework sets, and solutions are available on-line at www.BisonAcademy.com

Students with Special Needs: Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the Disability Services Office (www.ndsu.edu/disabilityservices) as soon as possible.

Academic Honesty: The academic community is operated on the basis of honesty, integrity, and fair play. NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of the Provost. Informational resources about academic honesty for students and instructional staff members can be found at Standards for Academic Honesty & Integrity at NDSU: Student Resources and Standards for Academic Honesty & Integrity at NDSU: Faculty.

Academic Honesty Defined: All written and oral presentations must “respect the intellectual rights of others. Statements lifted verbatim from publications must be cited as quotations. Ideas, summaries or paraphrased material, and other information taken from the literature must be properly referenced” (Guidelines for the Presentation of Disquisitions, NDSU Graduate School).

FERPA Statement: Your personally identifiable information and educational records as they relate to this course are subject to FERPA.

ECE Honor Code: On my honor I will not give nor receive unauthorized assistance in completing assignments and work submitted for review or assessment. Furthermore, I understand the requirements in the College of Engineering Honor System and accept the responsibility I have to complete all my work with complete integrity.

Veterans and Student Soldiers: Veterans and student soldiers with special circumstances or who are activated are encouraged to notify the instructor in advance.