

# ME676-MECHATRONICS

## BASIC INFORMATION

**The Course: ME 676 - Mechatronics**

**Number of credits:** This is a 3-credit course with a weekly load of 3 lectures of 50 minutes each; it is open to all graduate students

Meeting Times: Lectures: MWF 10:00am – 10:50 am (AGHill 128); Labs: MWF 10:00am – 10:50 am (AGHill 228)

**Term and Year:** Spring 2022

**Instructor's name:** Majura Selekwa

**Office location:** Dolve 102B

**Office hours:** WF: 3:00pm-4:30pm

- You may meet with me either in person during office hours or virtually using Zoom by appointment.

**Phone Number: 701-231-5667**

**Email Address: Majura.selekwa@ndsu.edu**

## BULLETIN DESCRIPTION

Design and development of mechatronic systems that require an integrated knowledge of mechanical engineering, electronics, computer science and control theory.

## COURSE OBJECTIVES

The proposed course has three main objectives: (a) to equip students with necessary tools for understanding, designing and developing mechatronic systems, (b) to train students to be innovators by using mechatronic knowledge in designing machines for a variety of applications, and (c) to empower students with the ability to work in multidisciplinary teams by being able to communicate effectively to team members of different backgrounds. At the end of this course students should be able to:

1. Analyze and solve event driven automation problems using electronic logic gates, counters, registers and memory chips. **ABET Outcomes 1, 2, 6.**
2. Choose appropriate sensors and actuators for various applications. **ABET Outcomes 1, 2, 6.**
3. Use a microprocessor system to read sensors and drive actuators in automating the operation of a mechanical system. **ABET Outcomes 1, 2, 6.**
4. Design and build a simple computer controlled mechanical system; and write effective technical reports about their designs **ABET Outcomes 1, 2, 6.**
5. Work in groups and gain multidisciplinary skills that integrate mechanical systems, electronics, computer science and control technology. **ABET Outcomes 5.**
6. Read and understand technical data sheets from various manufacturers of mechatronic parts. **ABET Outcome 7**
7. Additionally, graduate students should be able to conduct independent research and develop new mechatronic systems technologies.

## REQUIRED STUDENT RESOURCES

**Recommended Textbook:** J. E Carrier, R. N. Ohline, and T. W Kenny: *“Introduction to Mechatronic Design,”* Prentice Hall 2011. Lecture handouts will be provided regularly by the instructor.

## EVALUATION PROCEDURES AND GRADING CRITERIA

The final grade will be determined by the student’s performance in homework assignments, laboratory sessions, one mid-term exam, and one comprehensive final exam. The final grade will be based on the following apportionment:

i.	Homework Assignments	20%
ii.	Laboratory/Project Assignments	40%
iii.	Research and Analysis paper	15%
iv.	Midterm-Test	15%
v.	Final Exam	10%

- All **laboratory or project assignments** will be done in groups of two students **at the end of each topic.**
- **Homework assignments** will be an individual effort, and will be assigned **at the end of each topic**
- **The midterm test** will be an individual effort and will be held in **Week 11**
- **The research and analysis paper** will be an individual effort and will be assigned in **Week 13, due week 16**

**Grade Policy:** Grades will be assigned as follows: **A** (90-100), **B** (80-89), **C** (70-79), **D** (60-69), **F** (0-59).

Departmental policies require a grade of C or better in order to pass the course. **Students who attain a weighted score of 84 on coursework will be awarded A without taking the Final exam.**

#### TENTATIVE COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Introduction; Analog and Digital Control of Mechatronic Systems
2	Diode Circuits; Electronic Switches
3-4	Electronic Switches: BJT, MOSFET, IGBT
5-6	Combinational and Sequential Logic Circuits
7-8	DC, Stepper, BLDC Motor Control: H-Bridges and Inverters
9	Microcontroller Programming: Traffic Lights Control
10	User Interface: Dot Matrix Displays and Keypads
11	Servo Motor Control: PWM and Quadrature Encoders <b>-Midterm test</b>
12	UART Interface: GPS reception and Ultrasonic Sensing
13	Analog Interface: Temperature Control
14	SPI Interface: Laser Ranging, IMUs, Mobile Robot Control
15	IIC Interface: Laser Ranging, IMUs, Mobile Robot Control
16	CAN Interface: Radar Ranging, Mobile Robot Control <b>-Research paper</b>

#### COMMUNICATION

- Reminders, notification of any schedule or assignment changes will be communicated through NDSU email and posted on Blackboard announcements page.
- **Your NDSU email address is the official route for information.**

#### ATTENDANCE STATEMENT

According to [NDSU Policy 333 \(www.ndsu.edu/fileadmin/policy/333.pdf\)](http://www.ndsu.edu/fileadmin/policy/333.pdf), attendance in classes and labs is **required**; however, this semester due to COVID-19, I do not have an attendance policy as I normally would.

- **Do not come to class if you are sick; protect your health and the health of others by staying home and participate in class remotely.** For information on COVID-19, symptoms, testing, and steps to stay healthy see [https://www.ndsu.edu/studenthealthservice/covid\\_19/](https://www.ndsu.edu/studenthealthservice/covid_19/).
- You can view the lectures remotely and ask any questions you have on Blackboard Ultra (or Zoom). *Please* Students are expected to attend every class and remain in class for the duration of the session when it is safe to do so in accordance with NDSU guidance regarding COVID-19.
- In this course students should participate in the course mostly face-to-face. When needed, students are also able to participate virtually in synchronous or asynchronous discussions and activities and submit assignments virtually.
- I will be flexible regarding deadlines for students who are experiencing illness or other challenges related to COVID-19. Please contact me as early as possible if you think you may not be able to complete an assignment or participate in the course due to illness.

Veterans and student service members with special circumstances or who are activated are encouraged to notify the instructor as soon as possible and are encouraged to provide Activation Orders.

#### **INTELLECTUAL PROPERTY**

Refer to NDSU [Policy 190](#) on Intellectual property. **In this course recording the lectures with your own personal devices is prohibited.**

#### **ASSIGNMENTS**

- Blackboard will be used for quiz and report submission (and grading) for all students (for both face-to-face and remote participants). If you are sick and cannot complete your assignment, notify the course instructor as soon as practical, so that accommodations can be made.

#### **HEALTH EXPECTATIONS**

Information on COVID-19 and NDSU's response is at [https://www.ndsu.edu/admission/fall\\_2020\\_prelim\\_plan](https://www.ndsu.edu/admission/fall_2020_prelim_plan).

- NDSU requires students to wear face coverings in classrooms. Wearing face coverings helps reduce the risk to others in case you are infected but do not have symptoms.
- You must properly wear a face covering (covering both the mouth and nose) for the entirety of the class.
- Students should observe social distancing guidelines whenever possible. Students should avoid congregating around instructional space entrances before or after class.
- Students should exit the instructional space immediately after the end of class to ensure social distancing and allow for the persons attending the next scheduled class to enter the classroom.

#### **AMERICANS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT**

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](http://www.ndsu.edu/disabilityservices)) as soon as possible.

#### **APPROVED ACADEMIC HONESTY STATEMENT**

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 Registration and Records](#). Informational resources about academic honesty for students and instructional staff members can be found at [www.ndsu.edu/academichonesty](http://www.ndsu.edu/academichonesty).