

**MTRE 3710 — Mechatronics Engineering Fundamentals**  
**2019 Fall**  
**TR 12:30–1:45 p.m.**  
**Room Q 315**

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**Instructor:** Matt Marshall

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Office: Q 317

Office Hours: Tuesday and Thursday 9–11:30

***Recommended Textbooks:***

1. AVR Microcontroller and Embedded Systems: Using Assembly and C, by Mazidi, Naimi, and Naimi
2. Applied Mechatronics, by A. Smaili and F. Mrad
3. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, by W. Bolton
4. Introduction to Autonomous Mobile Robots, by Siegwart, Nourbakhsh, and Scaramuzza

**Prerequisites:** Engineering Standing and MATH 3260 and ((CSE 1322 and CSE 1322L) or MTRE 2610 or ME 1311) and (EE 2301 or EE 2305 or CS 3503)

**Learning Outcomes:**

- Create electrical circuits using diodes, LEDs, and transistors
- Perform selection of electric motors and gearing
- Design basic pneumatic circuits
- Apply wheel constraints to develop mobile-robot kinematics
- Perform forward and inverse kinematic analyses of mobile robots
- Employ basic principles of mobile-robot obstacle avoidance
- Program a mobile robot using the Robot Operating System (ROS)
- Program microcontroller input and output in C
- Program microcontroller specialized hardware (for example, timers)

**Course Description:** This course provides fundamental skills for the mechatronics engineer. Topics include sensors and actuators, especially pneumatics and DC motors; programming and interfacing with the AVR microcontroller; and robot kinematics and obstacle avoidance with mobile robots. Tentative schedules for the class and lab are provided at the end of the syllabus.

**Grading:**

- Online quizzes 5%
- Group exercises 5%
- Kinematics programming assignment 5%

- Labs 15%
- Report rough draft 3%
- Report final draft 7%
- Exams 60% — best three out of four (20% each)

The exam schedule will be announced at least one week in advance. All exams are open-book and open-notes unless stated otherwise. The final exam is comprehensive. A student will be allowed to drop one test grade for the term. If you are absent on test day for any reason that test grade will count as the dropped one — the course grade will be figured based on the other three exam grades.

There will be absolutely no makeup test or quiz available in order to guarantee the course grade being fair to everyone in the classroom; one has to take the same test at the same time as everybody else.

**Communication:** Course material will be disseminated in D2L including lecture notes etc. All course announcements will sent via email. Email is also the surest means of contacting the instructor regarding problems or for requests.

For help with course material, office visits are strongly encouraged.

**Attendance Policy:** Attendance is optional. A student is responsible for any material covered in class. No credit is possible for any missed grade items. Similarly, no credit can be earned for a missed lab.

**Academic Honesty:** Information about the Honor Code can be found at <https://web.kennesaw.edu/scai/content/ksu-student-code-conduct>.

**Miscellany:** The KSU Writing Center helps students in all majors improve their writing. Experienced, friendly writing assistants help with topic development, revision, research, documentation, grammar, and more. For more information or to make an appointment, visit [writingcenter.kennesaw.edu](http://writingcenter.kennesaw.edu) or stop by English Building, Room 242 (Kennesaw campus) or Johnson Library, Room 121 (Marietta campus).

The Southern Polytechnic College offers drop-in tutoring at its Peer Mentoring Center, located in room Q 306. Tutors are available for a dozen subjects, including Graphics, Dynamics, and others. The complete list of supported courses, as well as a schedule of availability for each subject, can be found on the college website at [engineering.kennesaw.edu/peer-mentoring-center](http://engineering.kennesaw.edu/peer-mentoring-center). The center is open from 9 AM to 9 PM, Monday through Saturday. Email questions to [peermentoringcenter@kennesaw.edu](mailto:peermentoringcenter@kennesaw.edu).

**Tentative Schedule:**

TUESDAY	THURSDAY
<div style="border: 1px solid black; display: inline-block; padding: 2px;">Aug 20th</div> Course introduction Mobile robotics introduction ROSbot introduction Sonar	<div style="display: flex; justify-content: space-between;"> <span>1</span> <span>22nd</span> <span>2</span> </div> Kinematics introduction
27th Mobile robot kinematics Q&A Day  <i>Lab — ROS basics</i>	<div style="display: flex; justify-content: space-between;"> <span>3</span> <span>29th</span> <span>4</span> </div> Kinematics
<div style="border: 1px solid black; display: inline-block; padding: 2px;">Sep 3rd</div> Kinematics  <i>Lab — ROSbot intro</i>	<div style="display: flex; justify-content: space-between;"> <span>5</span> <span>5th</span> <span>6</span> </div> Kinematics Instant center Octave file I/O Introduction of report

TUESDAY		THURSDAY	
10th	<b>7</b>	12th	<b>8</b>
Kinematics (Octave function)		Obstacle avoidance and path planning overviews	
<i>Lab — Wall following</i>			
17th	<b>9</b>	19th	<b>10</b>
<i>review</i>		<u>Exam I</u>	
<u>Report rough draft due</u>			
<i>Lab — Wall following (continued)</i>			
24th	<b>11</b>	26th	<b>12</b>
Diodes and transistors		Numbering and coding systems Microcontroller (MCU) introduction	
<i>Lab — SLAM and path planning</i>			
<span style="border: 1px solid black; padding: 2px;">Oct 1st</span>	<b>13</b>	3rd	<b>14</b>
I/O port programming		I/O port programming	
<i>Reading: §1.1–2, §4.1 up to Figure 4.5 (ignore assembly code examples), §7.1–3</i>			
<u>Report final draft due</u>			
8th	<b>15</b>	10th	<b>16</b>
Interrupts		Interrupts	
<i>Lab — Diode and transistor lab, plus MCU lab 1</i>		<i>Reading: §10.1 and 10.3–4, ignore all code examples except Examples 10-12 and 10-13</i>	
15th	<b>17</b>	17th	<b>18</b>
Interrupts		Timer	
<i>Reading: pages 312–317 (up to the “Normal Mode” subsection); the “Prescaler . . .” subsection; the “Clear Timer0 on compare match . . .” subsection; Examples 9-10, 9-13, and 9-18; and §9.3</i>			
<i>Lab — Digit on 7-segment display</i>			
22nd	<b>19</b>	24th	<b>20</b>
Timer		<i>review</i>	
<i>Lab — Multiplexing with timer and 7-segment</i>			
29th	<b>21</b>	31st	<b>22</b>
<u>Exam II</u>		Pneumatic valves and actuators	
<i>Lab — Multiplexing with timer and 7-segment (cont'd)</i>			

TUESDAY		THURSDAY	
Nov 5th Cylinder sequencing	<b>23</b>	7th Pneumatic and electric diagrams	<b>24</b>
12th DC electric motors and velocity profiles <i>Lab — Pneumatics I</i>	<b>25</b>	14th Motor torques for incremental motion Stepper motor	<b>26</b>
19th Gearing <i>Lab — Pneumatics II</i>	<b>27</b>	21st RMS torque Sizing electric motors	<b>28</b>
26th <b>Fall Break</b>		28th <b>Fall Break</b>	
Dec 3rd <i>review</i>	<b>29</b>	5th <u>Exam III</u>	<b>30</b>
10th (No class)		12th <b>Final Exam: 1–3 p.m.</b>	<b>31</b>