Microcomputer Interfacing
ENGR 3344

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Department: Department of Physics, Engineering and Astronomy
Class meeting time and place: Lecture TR 9:30 – 10:45 am / STEM 108; Laboratory M 3:00 – 5:50 pm / STEM 108

Course Description:
Microprocessor architecture, programming and interfacing. Introduction to assembly language programming, microcomputers, microcontrollers, instruction set, chip interfacing, addressing modes, interrupts, input/output and communication. Prerequisite: ENGR 3343 or PHYS 3343.

Text and Materials:
Devices Datasheets

Course Calendar:

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics</th>
<th>Laboratory</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Aug 23</td>
<td>Microprocessor Architecture, and Assembly</td>
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<tr>
<td>2</td>
<td>Aug 30</td>
<td>PIC Architecture, I/O Ports, and Programming</td>
<td>Lab 0 – PIC Preparing</td>
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<tr>
<td>3</td>
<td>Sep 6</td>
<td>Timer, and LCD</td>
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<tr>
<td>4</td>
<td>Sep 13</td>
<td>Motors, Servos, LEDs, and PWM</td>
<td>Lab 1 – I/O and LCD</td>
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<tr>
<td>5</td>
<td>Sep 20</td>
<td>Motors, Servos, LEDs, and PWM</td>
<td>Lab 2 – Time Analysis</td>
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<tr>
<td>6</td>
<td>Sep 27</td>
<td>Programming the PIC using C++</td>
<td>Lab 3 - PWM</td>
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<tr>
<td>7</td>
<td>Oct 4</td>
<td>Analog-to-Digital Conversion</td>
<td>Lab 4 – Motor Control</td>
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<tr>
<td>8</td>
<td>Oct 11</td>
<td>Analog-to-Digital Conversion</td>
<td>Lab 5 – C Programming</td>
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<tr>
<td>9</td>
<td>Oct 18</td>
<td>Interrupts</td>
<td>Lab 6 – A/D Conv.</td>
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<td>10</td>
<td>Oct 25</td>
<td>Interrupts</td>
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<tr>
<td>11</td>
<td>Nov 1</td>
<td>I2C</td>
<td>Lab 7 - Interrupts</td>
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<tr>
<td>12</td>
<td>Nov 8</td>
<td>I2C</td>
<td>Lab 8 – I2C</td>
</tr>
<tr>
<td>13</td>
<td>Nov 15</td>
<td>SPI</td>
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<td>14</td>
<td>Nov 22</td>
<td>Thanksgiving Break</td>
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<tr>
<td>15</td>
<td>Nov 29</td>
<td>SPI</td>
<td>Lab 9 - SPI</td>
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<tr>
<td>16</td>
<td>Dec 6</td>
<td>Exam 3 (Weeks 9-15)</td>
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Assignments:
The assignments will consist of the laboratory experiments. The student has a whole week to have a functional system capable of producing the expected output. The working system is due at the beginning of the next laboratory. The students will be required the following:

- Submit the code using D2L Dropbox
- Demonstrate the functionality of the system to the instructor

**Quizzes:**
Quizzes will be posted on D2L. The idea is to reinforce knowledge from lecture, and laboratories.

**Exams:**
There will be a total of three regular exams during the semester. The exams will be based on the assignments, and the materials covered during the lecture.

**Laboratory Reports:**
Two laboratory reports will be required during the semester. The first will be at the beginning of the semester, and the last at the end of the semester. The report will be written based on the results from the laboratory procedures.

**Grading Policy:**

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<table>
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<tbody>
<tr>
<td><strong>Homework</strong></td>
<td>35%</td>
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<tr>
<td><strong>Lab Reports</strong></td>
<td>20%</td>
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<tr>
<td><strong>Attendance</strong></td>
<td>5%</td>
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<tr>
<td><strong>Quizzes</strong></td>
<td>20%</td>
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<tr>
<td><strong>Exams</strong></td>
<td>20%</td>
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**Late Policy**
Any assignment should be returned in time. In the case that the assignment is returned late it will be affected by the following policy:

<table>
<thead>
<tr>
<th>Time Late</th>
<th>Deduction</th>
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<tbody>
<tr>
<td>Less than 2 hours</td>
<td>5</td>
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<tr>
<td>More than 2 hours less than 12</td>
<td>10</td>
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<tr>
<td>More than 12 hours less than 24</td>
<td>20</td>
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<tr>
<td>More than 24 hours less than 48</td>
<td>50</td>
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<tr>
<td>More than 48 hours</td>
<td>100</td>
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</table>

**Homework Guidelines**
As engineers you should learn how to be organized, you will need to present reports and results to your superiors and these need to be professional. For that reason, you will need to start learning how to be organized. The homework should be returned complying with the following format:

1. Use clean paper that will scan properly
2. Name should be on the top left corner
3. Pages should be numbered on the top right corner using the following format “3/10”
4. Problems should be organized and in order
5. Problem number should be clear and readable

Failing to comply with any of these will result in a **10 points** deduction.

**Attendance Policy:**
Attendance will be based on the Video Quizzes, and Attendance to Lecture/Laboratory Sessions. After watching the lecture videos, you will need to answer a video quiz related to the concepts covered in the lecture video. I will take attendance during the lecture/laboratory sessions, this is to ensure that you are
keeping up with the material, and practicing the concepts covered in the lecture videos. If you arrive late to any of the sessions is your responsibility to ensure that your attendance was recorded.

**Credit Hour Justification**
Meets 3 hrs/wk for 15 weeks, and also meets for a 2-hour final examination. This is a problem-oriented class and lab with homework problems. The lecture and lab combine for 3 hours and 27 minutes of contact time each week and the work outside of classes each week for the combined courses averages much more than 10 hours and 40 minutes in working homework problems, preparing and answering online quizzes, reading the book to understand the theories used in lecture and in homework problems and exams, reading the lab manual to prepare for the lab experiments done each week, writing up the lab experiments, writing formal laboratory reports, and studying for exams which include major exams and possibly short lecture quizzes.

**Asynchronous Content**
This course is following the flipped classroom methodology. This requires the students to cover the theory and concepts outside the classroom. Every week, the students will have to read and watch videos related to course material that will be covered the following week. It is crucial that you keep up with materials to get the best results from the face-to-face lecture time.

**Lecture Remote Delivery**
In case of quarantine or if you cannot attend the lecture for some important reason, please let me know so I can stream the class using zoom. This same method will be used in case I am not able to get on campus. The zoom link will be posted in D2L.

**Student Learning Outcomes**
By the end of the course, a successful student will be able to:
1. Describe the architecture used in PIC microcontrollers.
2. Program a PIC microcontroller using assembly, and C++.
3. Use digital I/O ports to interact with peripherals.
4. Use a LCD screen to display information using a PIC.
5. Measure analog signal using the PIC.
6. Explain the process of Digital-to-Analog Conversion.
7. General PWM signal to control devices such as: Motors, LEDs, Servos, etc.
8. Explain how PWM signal are used to control external devices.
9. Use Serial Peripheral Interface (SPI) protocols to communicate with external devices.
10. Describe how the Serial Peripheral Interface (SPI) protocol works.
11. Use Inter-Integrated Circuit (I2C) protocol to communicate with external devices.
12. Describe how the Inter-Integrated Circuit (I2C) protocol works.
13. Use logic analyzers to debug digital signals.
14. Learn how new peripherals work by reading datasheets, and using them to fabricate integrated systems.
15. Write effective laboratory reports.

**Program Learning Outcomes**
Graduates of the program will possess:
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and social contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

General Education Core Curriculum Objectives/Outcomes (EEO)
There are no specific general education core curriculum objectives in this course. This course is not a general education core curriculum course.

Academic Integrity (A-9.1)
Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism.

Definition of Academic Dishonesty
Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one's paper without giving the author due credit.

Please read the complete policy at http://www.sfasu.edu/policies/academic_integrity.asp

Withheld Grades Semester Grades Policy (A-54)
Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average.

Students with Disabilities
To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/.

Mental Health Statement for Syllabus:
SFASU values students’ mental health and the role it plays in academic and overall student success. SFA provides a variety of resources to support students’ mental health and wellness. Many of these resources are free, and all of them are confidential.
On-campus Resources:
SFASU Counseling Services
www.sfasu.edu/counselingservices
3rd Floor Rusk Building
936-468-2401

SFASU Human Services Counseling Clinic
www.sfasu.edu/humanservices/139.asp
Human Services Room 202
936-468-1041

Crisis Resources:
Burke 24-hour crisis line 1(800) 392-8343
Suicide Prevention Lifeline 1(800) 273-TALK (8255)
Crisis Text Line: Text HELLO to 741-741