

**MECHANICAL AND AEROSPACE ENGINEERING
ABET COURSE SYLLABUS**

COURSE NAME	ENGR 140 Introduction to Programming and Embedded Systems
REQUIRED?	Required for ME and AE
CREDIT HOURS	4 Credits (3+3P)
CONTACT HOURS	150 minutes (Lecture) and 150 minutes (Practicum) per week for 15 weeks
INSTRUCTOR NAME	Bárbara Gamillo
INSTRUCTIONAL MATERIALS	Textbook: (Required) <i>Web-based, interactive textbook: Programming in C</i> (https://www.zybooks.com/catalog/programming-in-c-2/)
CATALOG COURSE DESCRIPTION	An introduction to programming and the field of embedded systems. Starting from the basic programming concepts, this course uses microcontrollers, sensors, motors, and other peripheral devices to support the learning and application of the problem-solving process through embedded systems. This course focuses on reading, writing, debugging, testing, and documenting computer programs.
PREREQUISITES	E T 182 or ENGR 130 or PHYS 1310G
COURSE LEARNING OUTCOMES	<p><u>After completing this course, a student should be able to:</u></p> <ol style="list-style-type: none"> 1) Set up and use a rich programming environment for programming; 2) Employ effective use of the problem-solving process; 3) Analyze existing code; 4) Write, debug, and test code given software requirements; 5) Apply testing and documentation best practices; and 6) Transfer and apply programming knowledge to an Arduino-based environment.
RELATIONSHIP TO ABET CRITERION 3 (ASSESSED?)	<p>Criterion 3.1 an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.</p> <p>Criterion 3.2 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 factor.</p> <p>Criterion 3.5 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.</p>

	<p>Criterion 3.7 an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. (This course is not officially assessed for Criterion 3 purposes)</p>
<p>TOPICS COVERED</p>	<p>Lecture – C programming (VS Code environment)</p> <ol style="list-style-type: none"> 1. Setting up a C programming environment using Visual Studio Code and the minGW compiler. 2. Parts of a program in C programming 3. The 7-step problem-solving process. 4. C basics – variables, the printf(), and basic operators. 5. More on C basics – more on operators and basic operations. 6. Branching – if statements and their variations. 7. Flow diagram basics 8. Exam1: Programming Basics & Branching 9. Basics of multi-function programs and the parts of a user-defined function. 10. Repetition – while loops and the basics of nested branching 11. More on repetition – for loops and nested looping 12. More on branching – the switch statement 13. Basics of data validation – do...while loops and the break statement. 14. Exam 2: Looping and More on Branching 15. One-dimensional array and algorithm basics – sorting. 16. Basics of two-dimensional arrays 17. Introduction to pointers 18. Exam 3: Cumulative Final Exam <p>Lab – Arduino programming (Arduino IDE): Regular labs are done with the following kit: https://www.amazon.com/Arduino-Sensor-Kit-Base-TPX00031/dp/B08W9X7C3H/</p> <ol style="list-style-type: none"> 1. Setting up an Arduino programming environment using the Arduino IDE and the Seeeduino hardware. 2. Parts of an Arduino sketch and the serial monitor. 3. Arduino documentation – referencing documents to understand the structure, embedded functions, and Arduino variables. 4. Using the Arduino documentation to control outputs – LED, buzzer, and push button. 5. Branching and analog inputs – more on the serial monitor, intro to the potentiometer, and more on controlling the LED. 6. Controlling the outputs with hardware input (temperature sensor) or user input.

	<ol style="list-style-type: none">7. Looping – Basics of motors and the use of external libraries.8. Nested looping – More on motors.9. Array Basics – LED ring and more on external libraries.10. User-defined functions and the use of multiple hardware components. <p>Final Project: Putting all together – obstacle-avoiding robot (from scratch). Final project is done with https://www.amazon.com/Arduino-Robotics-Science-Engineering-Building/dp/B07KPZ8RSZ/.</p>
POLICIES	<p>The NMSU Mechanical and Aerospace Engineering Department has developed a single addendum to each course syllabus, containing information common to all courses in the curriculum. Please refer to this document for policies and procedures relevant to each ME and AE course. See https://mae.nmsu.edu/resources/mae-common-syllabus-addendum.html for some details.</p>