Discipline: Electronics

Degree Credit [X]
Non Credit [ ]
Nondegree Credit [ ]
Comm Service [ ]

Riverside Community College District
Integrated Course Outline of Record

Electronics 26

College: R___ M___ N_X_
Lecture Hours: 36
ELE-26: Microcontrollers Lab Hours: 54
Units: 3.00

COURSE DESCRIPTION

Prerequisite(s): None.

Advisory: ELE 25
Computer number systems, codes, and arithmetic functions; microcontroller functions, architecture, instruction sets, addressing modes, internal operations, PIA interfacing, and I/O operations. Introduction to operating systems. 36 hours lecture and 54 hours laboratory.

SHORT DESCRIPTION FOR CLASS SCHEDULE

Introduction to microcontrollers.

ENTRY SKILLS

Before entering the course, students will be able to:

1. Convert between the binary and decimal number systems and recognize the most commonly used binary codes.
    - ELE 25 - Convert between the binary and decimal number systems and recognize the most commonly used binary codes.
2. Explain the operation of digital logic gates.
    - ELE 25 - Explain the operation of digital logic gates.
3. Identify the more commonly used integrated circuit families used in digital equipment and discuss their operation and characteristics.

- ELE 25 - Identify the more commonly used integrated circuit families used in digital equipment and discuss their operation and characteristics.

4. Use Boolean algebra to express logic operations and minimize logic circuits in design.
   - ELE 25 - Use Boolean algebra to express logic operations and minimize logic circuits in design.

5. Discuss the operation and application of counters, shift registers, and other sequential and combinational logic circuits.
   - ELE 25 - Discuss the operation and application of counters, shift registers, and other sequential and combinational logic circuits.

STUDENT LEARNING OUTCOMES

Upon successful completion of the course, students should be able to:

Explain the basic operation of a microcontroller.

Describe and control input and output operations.

Develop a flowchart to define and solve a problem.

Write a program that implements a flow chart for a microcontroller.

COURSE CONTENT

Lecture

1. Number systems, codes and computer arithmetic
   a. Binary - Using 1s and 0s/ons and offs to do mathematics and store numbers
   b. Octal - Using 0-7 to do mathematics and store numbers
   c. Decimal - Using 0-9 to do mathematics and store numbers (this is what most people are used to working with)
   d. Hexidecimal - Using 0-F to do mathematics and store numbers.
   e. Addition, subtraction, multiplication, and division of each type of number system.
2. Microcontroller basics
   a. What a microcontroller looks like
   b. Inputs and outputs on the board/chip
   c. How to power the chip

   d. How to hook it up to a computer and develop communications with the chip
3. Introduction to programming
   a. Communications with the chip
   b. variable definition, manipulation and storage.
   c. Communications with inputs and outputs
   d. Activating inputs and outputs
4. Explain the specific microcontroller being used in class
5. Interfacing the microcontroller to the outside world
6. Operating systems
   a. Programming applications
   b. Using a Personal computer to program the chip.
7. How microprocessors are relevant to specific industries.

Lab

1. Practice programming microcontollers using the topics presented during lecture.
2. Lab activities such as using the mircocontroller attached to some sort of student designed or mass produced robotic chaise to perform five different tasks.
3. Practice communications with the chip
4. Setting off different inputs and activating different outputs.

METHODS OF INSTRUCTION

Methods of instruction used to achieve student learning outcomes may include, but are not limited to:

- Present class lectures/discussions in order to assist students in achieving the learning outcomes by reviewing relevant course content such as using numbering systems when programming a microcontroller.
- Perform assigned lab activities using a microcontroller in order to expose the student to situations/problems which reinforce lecture presentation material.
- Show videos/films/slides/handouts in order to give the student a better feeling of exposure to activities within industry and related fields. Such as Youtube videos on how microcontrollers are used in industry.
- Field trips to selected sites in order to give the students an experience the applications of the course concepts of design as applied in the environmental design professions as related to microcontrollers.
- Develop and assign problem solving tasks and activities in order to assist the student in achieving learning objectives and by offering students opportunities to develop a variety of alternate design solutions to specific problems, while providing individualized learning opportunities.
- Off site meetings at selected locations in order to provide students the experience of analyzing structures and spaces relative to microcontrollers.

- Create and assign pair and small group activities such as preparing an analysis of a given composition using the relevant course content. A competition format may be used in this process. This is done in order to help students achieve outcomes specific to microcontrollers by stimulating individual participation in group activities.
- Invite or visit guest lecturers in order to bring current industry experience directly into the classroom and help students attain objectives through direct interface with active professionals.
- Develop and assign web-based/web-enhanced tasks and activities in order to assist the student in achieving learning objectives by offering opportunities to interact with other students online, while also providing individualized learning opportunities.

METHODS OF EVALUATION

Students will be evaluated for progress in and/or mastery of learning outcomes by methods of evaluation which may include, but are not limited to:

- Individual and small group projects are evaluated based on the standards that would be applicable to success in the field or professions employing microcontrollers.
- Oral reports and visual presentations designed to demonstrate student achievement of course learning objectives such as demonstration of a student designed microcontroller robotic system.
- Laboratory projects are designed to evaluate their ability to accurately construct and analyze circuitry and to present their understanding of the concepts learned in class.
- Quizzes and exams to evaluate student understanding of microcontroller programming and operation.

SAMPLE ASSIGNMENTS

Outside-of-Class Reading Assignments

- Students will be assigned reading coursework on number theory, binary, octal, hexadecimal.
- Research on for coursework on different types of sensors, sonar, optical, photo.
- Research on coursework for sample programs for sensor usage.

Outside-of-Class Writing Assignments

- Students will be required to create flow chart, to enable them to better solve complex problems.

Other Outside-of-Class Assignments

- Students may be required to create a project for the class. Design a circuit or device to perform a specific task, sonar sensors to measure distance.
- Students will be required to perform simple programming of microcontroller, Arduino or similar.

COURSE MATERIALS

All materials used in this course will be periodically reviewed to ensure that they are appropriate for college level instruction. Possible texts include:

Blum, J.. Exploring Arduino: Tools and techniques for engineering wizardry. 1 ed. Wiley, 2013.
Karvinen, T.. Make: Sensors: A hands-on primer for monitoring the real world with Arduino and Raspberry Pi. 1 ed. Maker Media, Inc, 2014.
Purdum, J.. Beginning C for Arduino: Learn C programming for Arduino. 2012 ed. Apress, 2012.

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