ENGT M06: INTRODUCTION TO MICROPROCESSORS AND MICROCONTROLLERS

Originator

srelle

Co-Contributor(s)

Name(s)
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College

Moorpark College

Attach Support Documentation (as needed)

Engr Adv Comm Meet_Agenda_2018.pdf
Recommendations of the committee.pdf
Attendees for Spring 2019 Advisory Committee.pdf
Engr Adv Comm Meet_Agenda_2019.pdf
Recommendations - Spring 2018.pdf
List of Attendees.pdf
ENGT M06_state approvla letter_CCC000608543.pdf

Discipline (CB01A)

ENGT - Engineering Technology

Course Number (CB01B)

M06

Course Title (CB02)

Introduction to Microprocessors and Microcontrollers

Banner/Short Title

Intro Microprocess Microcontrl

Credit Type

Credit

Start Term

Spring 2020

Catalog Course Description

Introduces the basics of microprocessor and microcontroller functions and architecture including internal operations, input/output (I/O) ports, tri-state buses, memory, instruction sets, interrupts, addressing modes, and address decoding. Uses machine language and assembly language programming and logical and mathematical operations for assembly, Peripheral Interface Adapter (PIA) interfacing as well as troubleshooting techniques. Includes the design of hardware, software, and interfacing circuitry to provide microprocessor- or microcontroller-based functions or systems.

Taxonomy of Programs (TOP) Code (CB03)

0934.00 - *Electronics and Electric Technology

Course Credit Status (CB04)

D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)

B (Transferable to CSU only)

Course Basic Skills Status (CB08)

N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)

C - Clearly Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
A - Primarily Developed Using Economic Development Funds

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
Y - Not Applicable

Support Course Status (CB26)
N - Course is not a support course

Field trips
May be required

Faculty notes on field trips; include possible destinations or other pertinent information
Naval Base in Point Mugu or in Port Hueneme; or local engineering companies.
(Alternative assignments may be substituted for the field trip)

Grading method
Letter Graded

Alternate grading methods
Credit by exam, license etc.

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture
Minimum Contact/In-Class Lecture Hours
35
Maximum Contact/In-Class Lecture Hours
35

Activity

Laboratory
Minimum Contact/In-Class Laboratory Hours
52.5
Maximum Contact/In-Class Laboratory Hours
52.5

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
87.5
Total Maximum Contact/In-Class Hours
87.5

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
70
Maximum Outside-of-Class Hours
70

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
157.5
Total Maximum Student Learning Hours
157.5

Minimum Units (CB07)
3
Maximum Units (CB06)
3

Prerequisites
ENGT M02

Entrance Skills

Prerequisite Course Objectives

ENGT M02-demonstrate the operation of electronic lab equipment to test components and circuits by properly connecting and operating the following standard test equipment: power supplies, function generators, ammeters, voltmeters, ohmmeters, digital multimeters, and oscilloscopes.
ENGT M02-explain the operation of digital logic gates.
ENGT M02-identify the more commonly used integrated circuit families used in digital equipment and discuss their operation and characteristics.
ENGT M02-use Boolean algebra to express logic operations and minimize logic circuits in design.
ENGT M02-discuss the operation and application of counters, shift registers, and other combinational and sequential logic circuits.

Requisite Justification

Requisite Type

Prerequisite

Requisite

ENGT M02

Requisite Description

Course in a sequence

Level of Scrutiny/Justification

Content review

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	select the most suitable microprocessor or microcontroller for a given application, considering a given set of constraints, based on knowledge gained in this course and the understanding of the specifications supplied by the manufacturer.
2	troubleshoot by locating and identifying a faulty component in a malfunctioning microprocessor/microcontroller-based circuit or system using analytical and experimental techniques learned in class.
3	design and construct a microprocessor/microcontroller-based circuit or system, by specifying hardware and software, to perform a specified function.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	explain the basic functions, operations, and architecture of microprocessors and microcontrollers.
2	analyze the behavior of particular microprocessors and microcontrollers studied in class according to fundamental laws and formulas.
3	develop a flowchart to define a problem and map a solution based on analytical and experimental techniques learned in class. Write a program that implements this flowchart for a microprocessor/microcontroller-based function.
4	design, construct, and evaluate the efficacy of a microprocessor/microcontroller-based circuit or system according to a given set of requirements and constraints including, but not limited to, power consumption, speed, and cost.

Course Content

Lecture/Course Content

- **10% -** Number Systems, Codes and Computer Arithmetic
  - Binary: Using 1s and 0s/ons and offs to do mathematics and store numbers
  - Octal: Using 0-7 to do mathematics and store numbers
  - Decimal: Using 0-9 to do mathematics and store numbers (this is what most people are used to working with)
  - Hexidecimal: Using 0-F to do mathematics and store numbers
  - Addition, subtraction, multiplication, and division of each type of number system
- **15% - Microprocessor and** Microcontroller Basics
  - Architecture, function, and operation
  - Memory: Read Only Memory (ROM), Erasable Programmable Read Only Memory (EPROM), Electrically Erasable Programmable Read Only Memory (EEPROM), Random Access Memory (RAM)
  - Circuit description
  - Addressing
  - Input/Output (I/O) ports
  - Powering the chip
  - Connecting to a computer and developing communication
- **25% -** Introduction to Programming
  - Machine language and assembly language
  - Variable definition, manipulation, and storage
  - Communications with inputs and outputs
  - Activating inputs and outputs
- **10% - Interfacing Using the Peripheral Interface Adapter (PIA) Chip**

    - Hardware
    - Programming
    - Interfacing with specific industrial applications
- **10% - Interrupts**
    - Basic operation
    - Appropriate uses
    - Programming
- **15% - Troubleshooting**
    - Circuit analysis
    - Program analysis
- **15% - Operating Systems and Relevance to Specific Industries**
    - Programming applications
    - Using personal computers to program PIA chips
    - Microprocessor and microcontroller relevance to specific industries

Laboratory or Activity Content

- **5% - Locating and Identifying Component Parts of Microprocessors and Microcontrollers**
    - Data bus, Address bus, Control bus
    - Memory
    - I/O ports
- **5% - Using an Oscilloscope to Observe and Measure Signals**
- **5% - Determining Address Space Occupied by a Memory or I/O Device**
- **25% - Programming Microcontrollers Using Lecture Topics**
    - Machine language vs. Assembly language
    - Connect to a robot to perform several tasks
- **25% - Communicating with the PIA Chip Using Lecture Topics**
    - Programming
    - Interface external hardware and devices to a computer
- **20% - Designing, Constructing, and Operating a Microprocessor/Microcontroller-Based Product or System of Student's Choosing**
- **15% - Troubleshooting**
    - Programming analysis
    - Circuit analysis

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises
Skills demonstrations

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Computational homework
Group projects
Individual projects
Laboratory activities
Laboratory reports
Objective exams
Performances
Problem-solving exams
Quizzes
Skills demonstrations
Skill tests

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Computer-aided presentations
Collaborative group work
Class activities
Class discussions
Demonstrations
Field trips

Group discussions
Guest speakers
Instructor-guided interpretation and analysis
Instructor-guided use of technology
Internet research
Laboratory activities
Lecture
Practica
Small group activities

Describe specific examples of the methods the instructor will use:

The instructor will use PowerPoint presentations, problem solving exercises, and demonstrations to explain the concepts of the course.

Representative Course Assignments

Writing Assignments

1. Answer questions from lectures, such as: Fill in a flowchart showing contents of registers and buffers throughout the cycles of execution of a short routine.
2. Provide written responses to textbook questions, such as: Write an executable short routine to program an I/O interface device for specified conditions.

Critical Thinking Assignments

1. Design and construct a microprocessor/microcontroller-based system to perform a specified function. Select the most suitable microprocessor or microcontroller from a range of possible choices and justify your selection. Specify all hardware components and their connections including the software and the programming languages used. An example would be a sonar system that can measure distances.
2. Troubleshoot by locating and identifying a faulty component in a given malfunctioning microprocessor-based circuit or system having specific symptoms using analytical and experimental techniques learned in class. An example would be to troubleshoot a robotic arm that sporadically speeds up during its lifting operation.

Reading Assignments

1. Read assigned chapters from the classic Microcontroller Technology textbook to learn about the history and background of microcontrollers, their software, interfacing, and applications.
2. Read scientific and technical journal articles relevant to advances in microprocessor- and microcontroller-based technology to expand understanding of their usage in research and industry.

Skills Demonstrations

1. Illustrate the ability to construct and test the functionality of microprocessor/microcontroller-based circuits or systems in the lab using the materials provided.
2. Illustrate the ability to troubleshoot a microprocessor/microcontroller-based circuit or system that is malfunctioning using the appropriate testing tools.

Outside Assignments

Representative Outside Assignments

1. Write a technical report documenting the design of a microprocessor/microcontroller-based system, specifying all software and hardware components and their interconnections, that uses sonar technology to measure distances.
2. Research on the Internet the practical uses of different types of sensors such as optical, photoelectric, temperature, and sonar in our current technology and industry.

Articulation

Equivalent Courses at other CCCs

College	Course ID	Course Title	Units
El Camino College	ECHT 191	Introduction to Microprocessors and Interfacing	3
Irvine Valley College	ET 120	Introduction to Microprocessors and Microcontrollers	4
Rio Hondo College	ELEC 240	Microprocessors and Microcomputing	3

District General Education

A. Natural Sciences

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

Course is CSU transferable
Yes

CSU Baccalaureate List effective term:
Spring 2020

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Textbook

Classic Textbook
Yes

Description
Spasov, P. (2004). *Microcontroller technology: The 68HC11 and 68HC12,*(5th ed.). Pearson.

Resource Type
Textbook

Classic Textbook
No

Description
Crisp, J. (2004). *Introduction to microprocessors and microcontrollers,* (2nd ed). *Elsevier.*

Resource Type
Textbook

Classic Textbook
No

Description
Kleitz, W. (1997). *Microprocessor and microcontroller fundamentals: The 8085 and 8051 hardware and software.* Pearson.

Resource Type
Textbook

Classic Textbook
No

Description
Ganguly, A.K., and Ganguly, A. (2012). *Microprocessors and microcontrollers: 8085, 8086 and 8051.* Alpha Science International Limited.

Resource Type
Manual

Description
Murthy, S. (2016). *Microprocessor and microcontroller lab manual: 8086 and 8051.* n.p., Kindle Edition.

Library Resources

Assignments requiring library resources
Writing, reading, critical thinking, outside assignments.

Sufficient Library Resources exist
Yes

Example of Assignments Requiring Library Resources
Research, using the Library's online resources, the various applications of sensors using microprocessor and microcontroller technology.

Primary Minimum Qualification
ENGINEERING TECHNOLOGY

Review and Approval Dates

Department Chair
08/24/2019

Dean
08/26/2019

Technical Review
08/29/2019

Curriculum Committee
09/03/2019

DTRW-I
09/12/2019

Curriculum Committee
MM/DD/YYYY

Board
10/08/2019

CCCCO
10/12/2019

Control Number
CCC000608543

DOE/accreditation approval date
MM/DD/YYYY