

1. Course number and name

COE 241 - Microcontrollers: Programming and Interfacing

2. Credits and contact hours

4 credit hours, 6 contact hours

3. Instructor's or course coordinator's name

Dr. Abdul-Rahman Al-Ali

4. Textbook, title, author, and year

R.B. Reese, J.W. Bruce and B.A. Jones. *Microcontrollers: From Assembly Language to C using the PIC24 Family*, Charles River Media, 2014.

Other supplemental materials

None

5. Specific course information

a. Brief description of content of the course (catalog description)

Examines the basic hardware building blocks, addressing modes and instruction sets of microprocessors and microcontrollers. Introduces selection criteria for microcontrollers. Covers digital and analog input/output, timers, interrupts and serial communications, programming and interfacing.

b. Prerequisites or co-requisites

Prerequisites: COE 210 (Programming I) or CMP 120 (Introduction to Computer Science I) or MCE 226L (Computer Applications in Mechanical Engineering I) and COE 221/CMP 210 (Digital Systems) and ELE 211 (Electric Circuits I) or ELE 225 (Electrical Circuits and Devices)

c. Indicate whether a required, elective, or selected elective course in the program

Required

6. Specific goals for the course

a. Specific outcomes of instruction

This course requires the student to demonstrate the following:

1. Describe the internal architecture and software model of a generic microprocessor and microcontroller
2. Program a microcontroller using a high-level language
3. Utilizing microcontroller digital I/O and analog I/O ports for interfacing applications
4. Understand interrupts/timers operations and use them for interfacing applications
5. Use microcontroller for serial communication
6. Interface a real-time process to a microcontroller and program the later to monitor, control, and operate such process

7. Understand various type of addressing modes and develop assembly based programs.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course

This course contributes in a significant way to the accomplishment of the following program outcomes:

Program outcome	Emphasis in this course
(a) an ability to apply knowledge of mathematics, science, and engineering	●
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	●
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	○
(d) an ability to function on multidisciplinary teams	●
(e) an ability to identify, formulate, and solve engineering problems	○
(f) an understanding of professional and ethical responsibility	
(g) an ability to communicate effectively	
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
(i) a recognition of the need for, and an ability to engage in life-long learning	
(j) a knowledge of contemporary issues	○
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	●

Emphasis: ● High; ● Medium; ○ Low; Blank – Nothing Specific Expected

7. Brief list of topics to be covered

- i. Microprocessors and microcontrollers architecture & programming models
- ii. Data organizations, data types
- iii. Programming and interfacing microcontroller using high-level language
- iv. Digital input and output ports programming and interfacing
- v. Analog inputs programming and interfacing
- vi. Timers programming and interfacing
- vii. Introduction to interrupts and memories
- viii. Serial communications programming
- ix. Addressing modes and Assembly instruction sets
- x. Programming and interfacing microcontroller using low-level language (Assembly Language)