

**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)