1. **Course number and name**
   COE 410 - Embedded Systems: Design and Applications

2. **Credits and contact hours**
   3 credit hours, 5 contact hours

3. **Instructor’s or course coordinator’s name**
   Dr. Abdul-Rahman Al-Ali

4. **Textbook, title, author, and year**
   None

**Other supplemental materials**
References available in the AUS library as COE 410 course pack:
http://aus.libguides.com/c.php?g=477080&p=3262122

5. **Specific course information**
   a. **Brief description of content of the course (catalog description)**
      Introduces embedded systems computing platforms and examines their basic building blocks. Covers programming and interfacing, process-controlled and time-controlled interrupt handling. Explores communication methods and real-time operating systems. Evaluates embedded systems design requirements and specifications, reviews embedded systems emerging applications. Includes laboratory work and team projects.

   b. **Prerequisites or co-requisites**
      **Prerequisites:** COE 241 (Microcontrollers: Programming and Interfacing) and ELE 241 (Electronics I) or ELE 225 (Electric 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 and understand the principal characteristics of embedded systems computing platforms such as RISC (PIC) & CISC (68HCS12) based microcontrollers
      2. Ability to program and interface embedded systems
      3. Explore communication methods and real-time operating systems
      4. Apply embedded system design methodologies by engaging in requirements elicitation, and the implementation and testing of project assignments
      5. Investigate and analyze emerging embedded systems applications.
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:

<table>
<thead>
<tr>
<th>Program outcome</th>
<th>Emphasis in this course</th>
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<tbody>
<tr>
<td>(a) an ability to apply knowledge of mathematics, science, and engineering</td>
<td>○</td>
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<td>(b) an ability to design and conduct experiments, as well as to analyze and interpret data</td>
<td>●</td>
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<td>(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</td>
<td>●</td>
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<td>(d) an ability to function on multidisciplinary teams</td>
<td>○</td>
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<td>(e) an ability to identify, formulate, and solve engineering problems</td>
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<td>(f) an understanding of professional and ethical responsibility</td>
<td>●</td>
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<td>(g) an ability to communicate effectively</td>
<td>●</td>
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<td>(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context</td>
<td>○</td>
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<td>(i) a recognition of the need for, and an ability to engage in life-long learning</td>
<td>○</td>
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<td>(j) a knowledge of contemporary issues</td>
<td>○</td>
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<td>(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</td>
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Emphasis: ● High; ○ Medium; ○ Low; Blank – Nothing Specific Expected

7. Brief list of topics to be covered
   i. Digital and analog inputs and outputs interface and programming review
   ii. Keypads, Alphanumeric displays and LCDs Interfacing and programming
   iii. Sensors and Actuators interface such as temperature, humidity, H-bridge and relays: design, implementation, measurement & error analysis
   iv. Timer Interrupts: Input Capture & Output Compare applications: Frequency measurement and PWM
   v. Interrupts Handling
   vi. Communication: Serial Communication (SCI), Serial Peripheral Interface (SPI) and Controller Area Network (CAN)
   vii. Wireless Embedded Systems Platform and Applications
   viii. Projects and Presentations.