Audit course
Common for T.E. Electrical, E/TC, Electronics, Computer, Information Technology, Mechanical

Fundamentals of Microcontroller and Applications

16 bit MSP430 microcontroller architecture, Pin diagram, Memory organization of MSP430, special function registers, GPIO control, (3 Hrs)

Interrupts and interrupt programming, Watchdog timer. System clocks. (2 Hrs)

Programming MSP430 in embedded C, Timers and RTC using MSP430, timer modes and its programming, (6 Hrs)

Analog interfacing and data acquisition: ADC and Comparator in MSP430 (2 Hrs)

Introduction to serial communication. (2 Hrs)

Introduction to IoT and related accessories. (5 Hrs)

Case study of applications such as "A Low-Power Battery less Wireless Temperature and Humidity Sensor with Passive Low Frequency RFID", "Implementing Wi-Fi Connectivity in a Smart Electric Meter" "Remote Controller of Air Conditioner Using MSP430" (5 Hrs)

Text Books:
1. Getting Started with the MSP430 Launchpad by Adrian Fernandez, Dung Dang, Newness publication ISBN-13: 978-0124115880
2. MSP430 microcontroller basics 1st Edition by John H. Davies (Author), Newnes Publication ISBN-13: 978-0750682763
3. Ajay V. Deshmukh, "Microcontrollers, Theory and applications", Tata McGraw-Hill Companies – 2005

Other References:
1. http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode
2. http://processors.wiki.ti.com/index.php/MSP430_16-Bit_Ultra-Low_Power_MCU_Training
3. RF430CL330H :
   - Datasheet: http://www.ti.com/lit/ds/symlink/rf430cl330h.pdf
4. RF430CL331H:
   - Datasheet: http://www.ti.com/lit/ds/symlink/rf430cl331h.pdf
5. Datasheet: RF430FRL15xH:
   - Datasheet: http://www.ti.com/lit/ds/symlink/rf430frl152h.pdf
   - User Guide: http://www.ti.com/lit/ug/slau506/slau506.pdf

6. CC2538:
   - Datasheet: http://www.ti.com/lit/ds/symlink/cc2538.pdf
7. CC256x:
   - Datasheet: http://www.ti.com/lit/ds/symlink/cc2560.pdf
8. CC2640:
   - Datasheet: http://www.ti.com/lit/ds/symlink/cc2640.pdf
   - User Guide: http://www.ti.com/lit/ug/swcu117f/swcu117f.pdf
9. CC3100 and CC3200: http://www.ti.com/lit/ug/swru368a/swru368a.pdf

List of Experiments: Compulsory Experiments:

1. Learn and understand how to configure MSP-EXP430G2 Launchpad digital I/O pins. Write a C program for configuration of GPIO ports for MSP430 (blinking LEDs, push buttons interface).
   Exercises:
   a) Modify the delay with which the LED blinks.
   b) Modify the code to make the green LED blink.
   c) Modify the code to make the green and red LEDs blink:
      i. Together
      ii. Alternately
   d) Alter the code to turn the LED ON when the button is pressed and OFF when it is released.
   e). Alter the code to make the green LED stay ON for around 1 second every time the button is pressed.
   f). Alter the code to turn the red LED ON when the button is pressed and the green LED ON when the button is released.

2. Learn and understand GPIO based Interrupt programming. Write a C program and associated GPIO ISR using interrupt programming technique.
   Exercises:
   a) Write the code to enable a Timer interrupt for the pin P1.1.
   b) Write the code to turn on interrupts globally

3. Implement Pulse Width Modulation to control the brightness of the on-board, green LED. This experiment will help you to learn and understand the configuration of PWM and Timer peripherals of the MSP430G2553.
   Exercises:
   a) Observe the PWM waveform on a particular pin using CRO.
   b) What is the maximum resolution of PWM circuitry in MSP430G2 Launchpad?
   c) Change the above code to create a PWM signal of 75% duty cycle on particular PWM pin.

4. The main objective of this experiment is to control the on-board, red LED by the analog input from a potentiometer. This experiment will help you to learn and understand how to configure an ADC to interface with a potentiometer.

   Exercises:
   a) Alter the threshold to 75% of Vcc for the LED to turn on.

b) Modify the code to change the Reference Voltage from Vcc to 2.5V.

Lab Manual:
1) www.ti.com/lab-maunals
Embedded System Design using MSP430 Launchpad Development Kit - Lab Manual