



Department : Electrical and Control Engineering

Lecturer : Dr. Mohamed Shoaieb

Course : Microcontroller Application

Course Code: EE 416

Date : 20 / 1 / 2015

Time : 2 hours

Marks: 40

Final Exam

Answer all the following questions

Q1 : [a] A sensor outputs a voltage from -2.3 to -1.1 V. For interface to an A/D, this needs to be 0 to 2.4 volts. Develop the required signal conditioning.

(4 Marks)

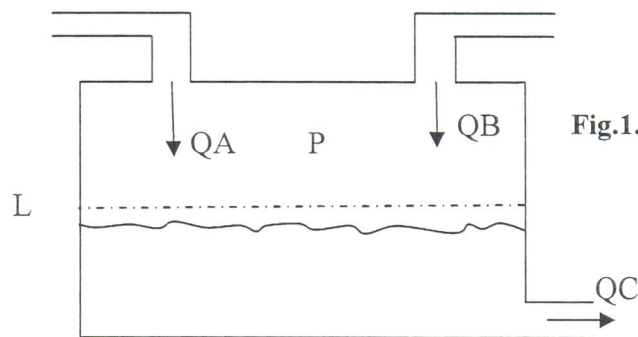
[b] A tank shown in Fig.1. has the following Boolean variables; flow rates, QA, QB and QC; pressure P and level L. All are high if the variable is high and low otherwise. Drive Boolean equations for two alarm conditions as follows: (6 Marks)

a- OV = overflow alarm:

1. If either input flow rate is high while the output flow rate is low, the pressure is low and the level is high.
2. If both input flow rates are high while the output flow rate is low and the pressure is low.

b- EP = empty alarm:

1. If both input flow rates are low, the level is low and the output flow rate is high.
2. If either input flow rate is low, the output flow rate is high and the pressure is high.



Q2: [a] Assume your microcontroller has an ADC system with the following properties: 8 bit resolution, Input range from 0 to +5 V, Clock frequency 15 KHZ, 8 Multiplexed single ended input channels, Sample & Hold 2 cycles from SOC, and Conversion time 13 cycles after Sample & Hold.

Determine:

(6 Marks)

1. Total conversion time.
2. Analog range and Digital range
3. Analog Resolution.
4. The digital output for an input is 3V.

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[b] Two pressure sensors are used to detect leakage in a pipeline system. Each sensor is placed at each end of the pipeline. Two leds indicate which side is leaking. If the difference between the two pressures is more than 1kpa, the led equivalent to the leaking side is ON. The sensor used operates with 2.5V/kpa.

Determine: 1. the input variables and output variables

2. Draw the flowchart

3. Write the C++ program

(8 Marks)


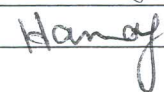
Q3: [a] What are the purpose of the ADC system and the Interrupt system? (4 Marks)

[b] Describe the settings of the ADMUX register? (3 Marks)

[c] What are the differences between Normal Mode and Clear Timer on Compare Match (CTC) in the Timer system? (3 Marks)

[d] Development the flowchart and write the C++ program to turn on the LEDs connected to port B of the microcontroller in a cyclic manner such that first only 1 LED is on, then 2 LEDs (LED1 and LED2) are on, then 3,4,..,8 are on. The process is repeated indefinitely with a 0.5 second delay between each output pattern. (6 Marks)

**GOOD LUCK**

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