



**UNIVERSITI KUALA LUMPUR
Malaysia France Institute**

**FINAL EXAMINATION
JANUARY 2014 SESSION**

SUBJECT CODE : FAB38204
SUBJECT TITLE : INDUSTRIAL INSTRUMENTATION
LEVEL : BACHELOR
TIME / DURATION : 3 HOURS
DATE :

INSTRUCTIONS TO CANDIDATES

- 1. Please read the instructions given in the question paper CAREFULLY.**
 - 2. This question paper is printed on both sides of the paper.**
 - 3. Please write your answers on the answer booklet provided.**
 - 4. Answer should be written in blue or black ink except for sketching, graphic and illustration.**
 - 5. This question paper consists of Two (2) Sections. Answer all questions in section A. For section B answer Two(2) only**
 - 6. Answer all questions in English.**
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THERE ARE 10 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer all questions.

Please use the answer booklet provided.

Question 1

- (a) **Figure 1** is a Distributed control level system (DCS). Named layer A, B and C
(3 marks)

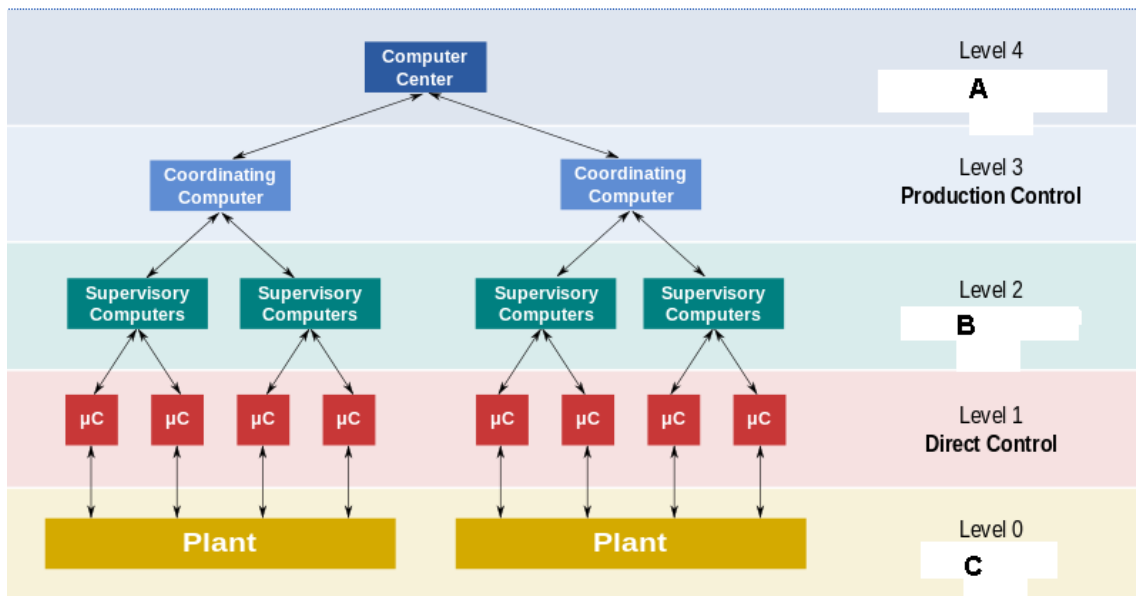


Figure 1: DCS

- (b) Given a TELEMETRY system in **Figure 2**. Answer Question below :
- i. Define TELEMETRY
(2 marks)
 - ii. Give **two (2)** examples the usage of TELEMETRY.
(3 marks)
 - iii. Give **one (1)** reason why do we need TELEMETRY system in certain application.
(2 marks)

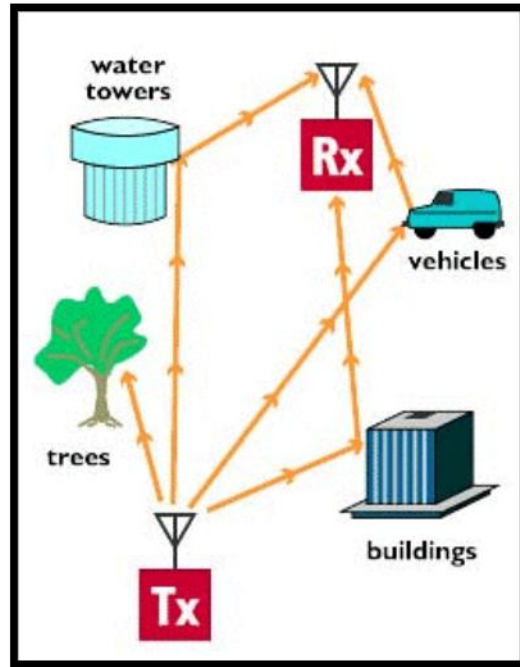


Figure 2: TELEMETRY

- (c) Give **one (1)** advantage of SCADA and one advantage of PI Process Book. (4 marks)
- (d) Repeatability and accuracy are the important aspect when selecting the type of instrument.
- i. Define precision and accuracy (4 marks)
 - ii. A man is shooting a bullet and several time the bullet is at the same position but not at the target, define whether the shooting is precise or accurate. (3 marks)

Question 2

- (a) The following **Table 1** represents a meter output in terms of output voltage from an experiment. The actual voltage reading is 10.2 V. Answer all the questions below by referring **Table 1**

Table 1 : Output Value in voltage.

No of reading	Output voltage
1	10v
2	10.9v
3	10v
4	10.8v
5	10.9v

- i. Calculate the absolute error, % error, relative accuracy, and % accuracy for each reading. (4 marks)
- ii. Calculate the average value. (2 marks)
- iii. Calculate the precision for reading no 2 and no 4 (3 marks)
- iv. Determine the most accurate reading from all the measurement. (2 marks)

Question 3

- (a) Sensor calibration is an important task before fitting them into a system. An engineer would like to install a flow sensor in a water pipe line. The flow is corresponding with the output of 0 to 20mA of a controller. The diameter of the pipe is 4 inch and the velocity is 30 inch/second. A company would like to use the cheapest equipment to measure the flow. Less maintenance but accurate.
- i. Calculate the flow. (3 marks)
 - ii. Determine the most suitable sensor and explain why you choose the sensor (3 marks)
 - iii. Elaborate the calibration using 3 points method up down calibration. (4 marks)
 - iv. A hysteresis error occurred during the calibration. Elaborate what and why is it happen. You may include illustration for detail explanation. (3 marks)
 - v. Elaborate the sensor operation that you have chosen. (4 marks)

Question 4

- (a) **Figure 3** is the valve body. Explain the usage of Stem and Seat Ring

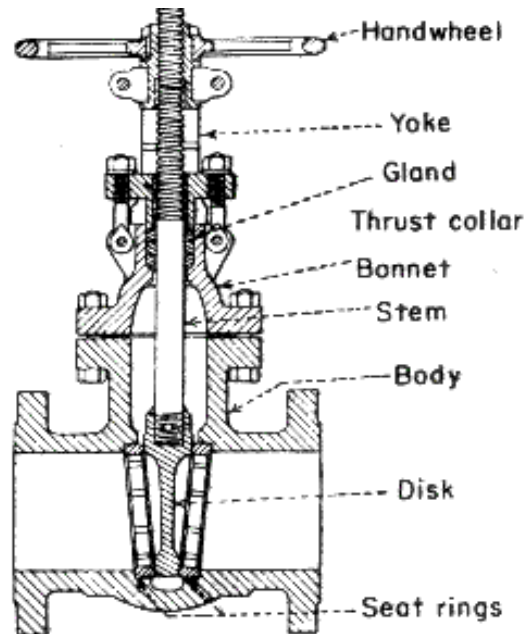


Figure 3: Valve construction

(4 marks)

- (b) Give **four(4)** consideration on choosing type of valve and sizing

(4 marks)

- (c) A pressure measuring instruments indicate a reading of 42.2 psi. The local atmospheric pressure is 14.7psia. Determine the corresponding gauge pressure (psig).

(3 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions only.

Please use the answer booklet provided.

Question 5

Given a milk pasteurization production as shown in **Figure 4**. By referring the detail operation, answer all questions. This process consists of Heating and cooling process. Initial process involves pump to supply milk from a close tank to starting process which is the heating process. The heating process uses a steam jacket. In order to maintain the heated milk, a temperature sensor is installed at the steam jacket to control the valve of the steam inlet. The milk will go through the centrifugal clarifier or a filter which is to separate any excessive water, dense particles or foreign material from milk properties and the last stage for this process is preheating using heat exchanger process to kill microorganism which can effecting the milk nutrients quality. All pump using centrifugal pump. All manual valves using gate valve hand operated. The last stage of overall process consists of pre-cooling and cooling sections. In pre cooling section the temperature of the milk reduced to certain level of temperature values to slow the development of germs growth the convey to cooling process. Then the milk will transferred to the close horizontal milk vessel.

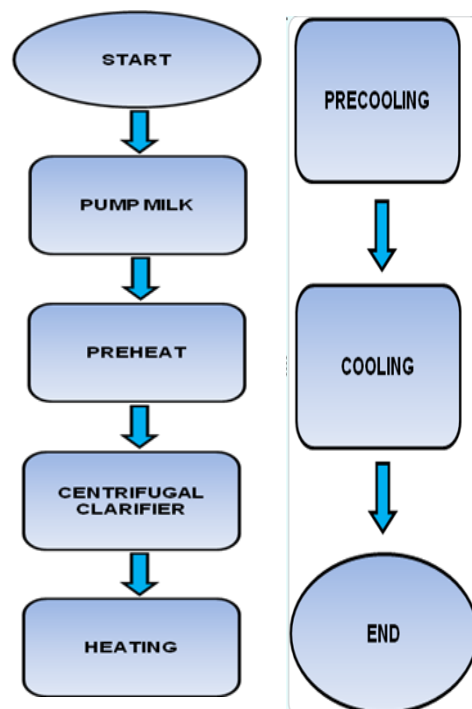


Figure 4: Process Flow

- i. Draw the P& ID drawing. Number all the valve and pump. Include maintenance and safety valve if required.

(15 marks)

- ii. PLC is use to control the valve. Current to Pneumatic converter is used to the control valve with 3 to 15 psi. Draw the connection between PLC, temperature sensor and the control valve.

(5 marks)

Question 6

- (a) **Figure 5** is a P&ID of a system. Answer the following questions based on this figure.

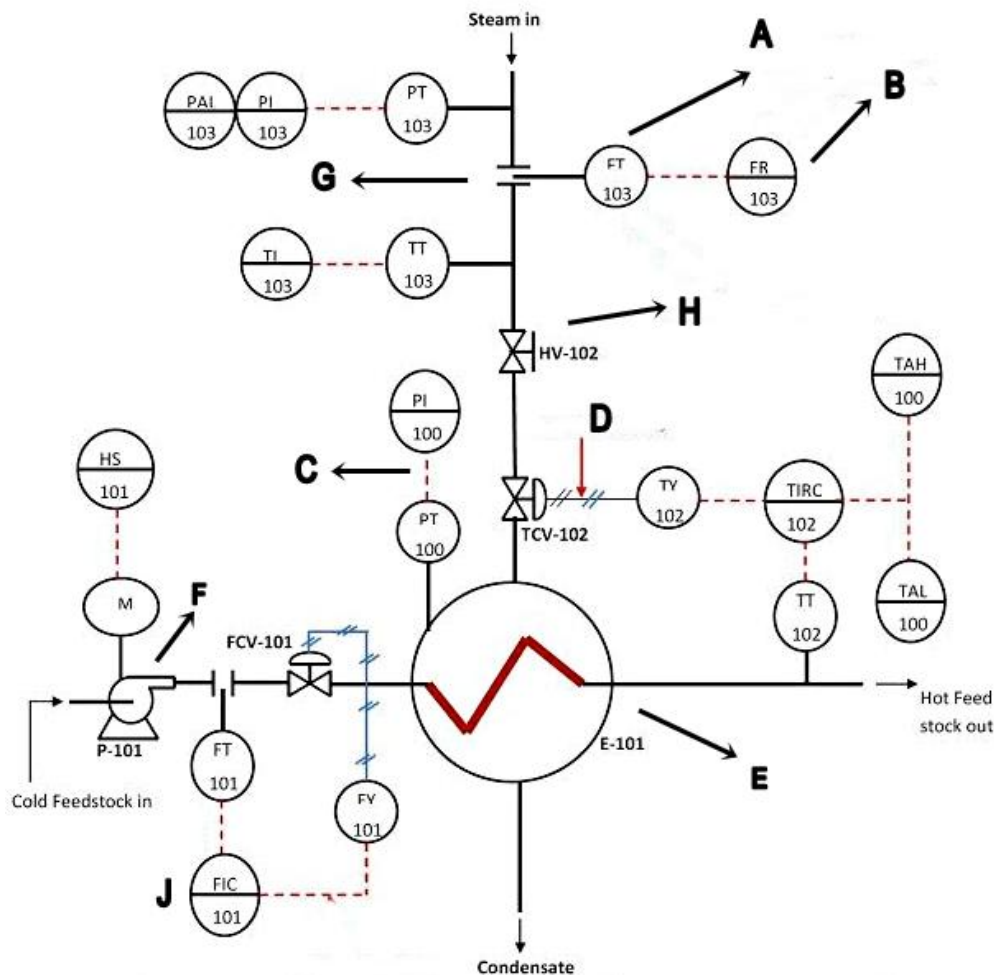


Figure 5: P&ID drawing of a system

- i. State the differences between symbols FT at A (with lines) and B (without line).
- ii. Determine the symbol E.
- iii. Determine the type of pump at F.
- iv. Define Line D.
- v. Define Line C.
- vi. Determine the type of sensor at G.
- vii. Determine the type of manual valve at H.
- viii. Describe the meaning of FR at B.
- ix. Describe the meaning of FIC at J.
- x. Draw symbol PLC.

(10 marks)

- (b) Based on statement given, design a P&ID drawing.

Given an open tank where the water flow needs to be regulated. Water or liquid will be flow through a pipe from a source to the open tank. A flow control valve will be used to regulate flow, the flow measurement is using orifice flow sensor. We want automatically adjust the set point of the flow controller with the aid of the flow sensor. As the flow being measured, the set point of the flow control valve is adjusted automatically. If flow goes up, set point control valve should be lowered. The orifice flow sensor transmits 4 to 20mA signal to the controller in the control room. The flow rate value also should be indicate at the sensor/meter itself. The flow controller will sent 0 to 20mA to the valve. The controller valve actuate by an electric motor. A level meter and indicator also located at the tank.

(10 marks)

Question 7

(a) **Figure 6** is an 8 bit ADC using 5 volt power supply. Answer the following question.

- i. Determine the voltage input if the digital output for 0000 0011 and 000 1111 (3 marks)
- ii. If Compare 3 bit ADC with 8 bit ADC, determine which is more precise. (3 marks)

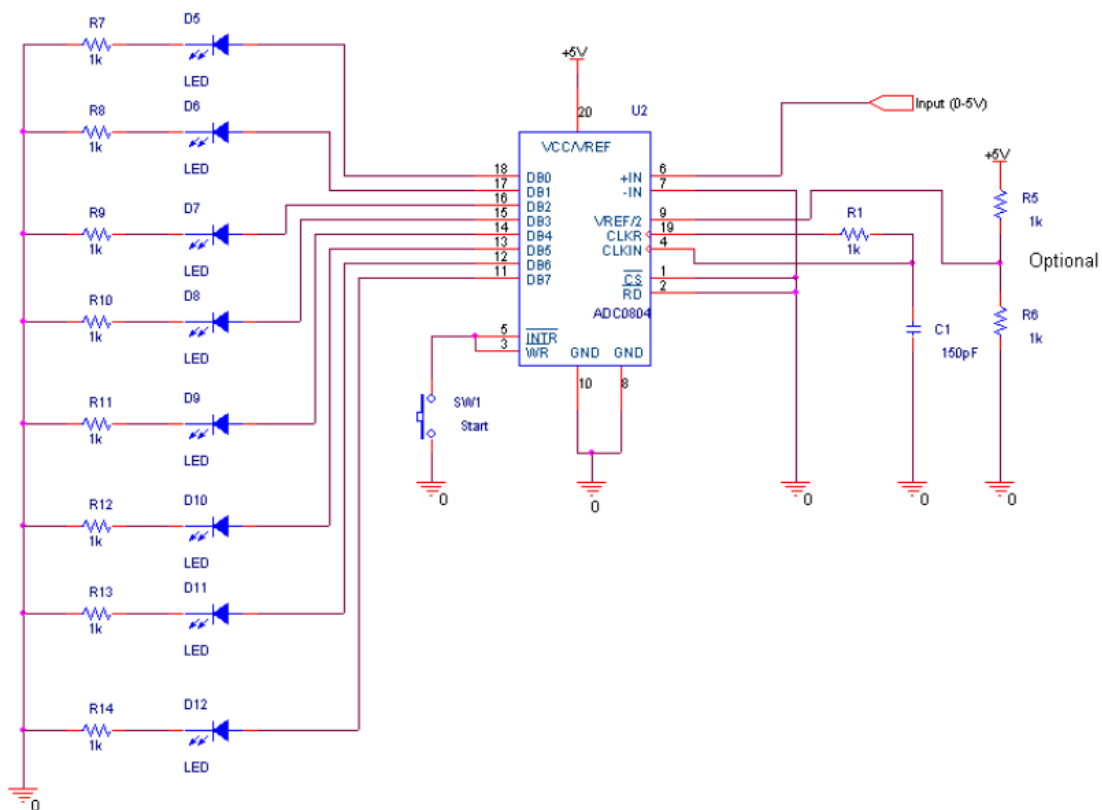


Figure 6: An 8 bit ADC using 5 volt power supply

(b) **Figure 7, Figure 8 and Figure 9** are signal conditioning circuits using operational amplifier. Answer the question below :

- i. At Figure 8, let $R_f = 10K$, $R_3 = 1K$, $R_4 = 2K$, calculate the voltage output

From output A. (4 marks)

ii. At Figure 9, Let $R_f = 10K$, $R_1 = 1K$, $R_2 = 2K$, calculate the voltage output from B. (4 marks)

iii. At Figure 10, From output B at Figure 9 is fetch to the input of amplifier figure to get output C. calculate the voltage output and draw the voltage output signal of output C versus input B. (6 marks)

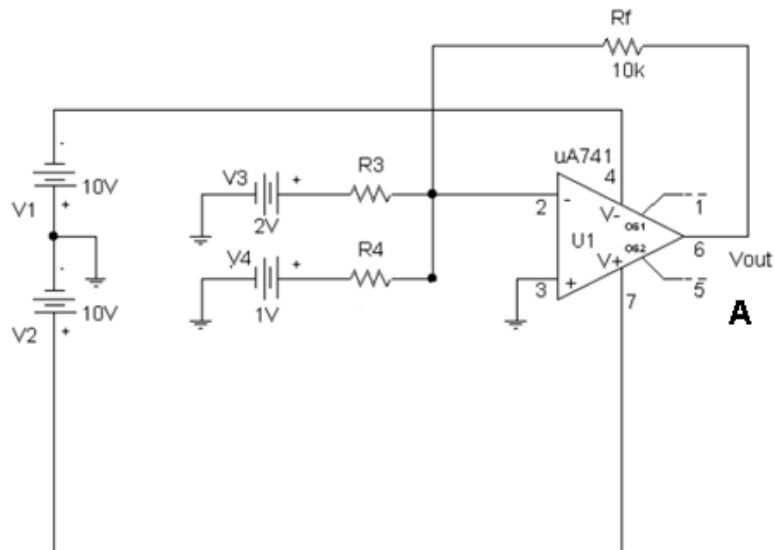


Figure 7: Signal Conditioning 1

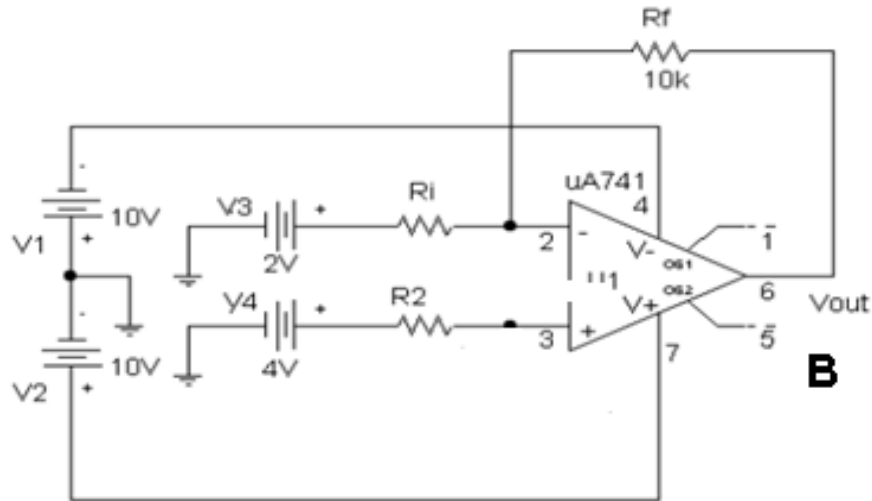


Figure 8: Signal Conditioning 2

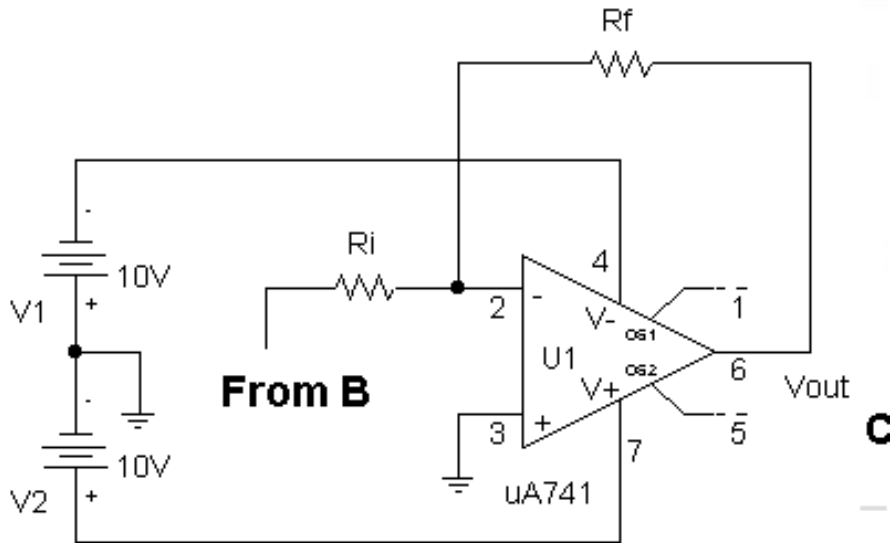


Figure 9: Signal Conditioning 3

END OF QUESTIONS