UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME	:	PROSES INSTRUMENTATION
COURSE CODE	:	BNQ 30304
PROGRAMME	:	BNN
DATE	:	JUNE 2017
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS PAPER CONSISTS OF **FIVE (05)** PAGES

Q1 (a) (i) Describe the basic elements involves in the measurement system of an exhaust gas temperature of a reactor to be displayed in a display unit.

(6 marks)

(ii) Draw a block diagram consisting basic elements in the measurement system from measurand to display unit described in **Q1(a)(i)** complete with its labels.

(4 marks)

(b) Numerical representation is divided into two types, analog and digital representation.

(i) Compare analog representation to digital representation

(6 marks)

(ii) Give examples of both representations in **Q1(b)(i)** and draw related figures.

(4 marks)

(c) Differentiate between static and dynamic instrumentation characteristics together with appropriate example.

(5 marks)

Q2 (a) The following information listed in **Table Q2(a)** are the static characteristics of an instrument obtained from the instrument manual handbook.

Table Q2(a)

Range of span	0 – 250 °C
Tolerance	+ 1.5 %
Threshold	0.1 second

(i) Define each of the static characteristics shown above in **Table Q2(a)**

(6 marks)

(ii) Assess the implications for each of the static characteristics given in **Table Q2(a)** in the usage of the instrument.

(9 marks)

(b) (i) Calculate the total sensitivity for the following assembly set of a measuring instrument as shown in **Table Q2(b)(i)**

Table Q2(b)(i)

RTD	35 Ω/°C
Wheatstone bridge	0.015 mV/Ω
Amplifier	10 mV/mV
Recorder	1.5 mm/mV

(2 marks)

(ii) Determine the temperature in **Q2(b)(i)** if the recorder shows a reading of 25 mm.

(2 marks)

(c) Identify **FOUR (4)** main objectives of a process control system with appropriate examples for each objective.

(6 marks)

Q3 (a) Compare the following sensors in term of (i) basic drawing with label, (ii) operational procedure with related equations, (iii) example of applications, (iv) advantages and disadvantages (minimum 2 of each).

- Bimetallic temperature sensor
- Radiation Pyrometer

Students are advised to use table for this question.

(15 marks)

(b) A distillation column operating at 450 °Celsius and 10 atm is used to produce kerosene from crude mineral oil. The operation involves batch processing and Feedback control system where only a single operator is needed to run the whole process. One morning, the control system detect that the pressure sensor for condenser has gone malfunction. One of the suspected reason is due to the effect of corrosive environment. The exact pressure sensor has been ceased to exist in the market and replaced by a new type of sensor with an increase in resistance to corrosion. As a technologist, you are required to **propose a shortlist** (questions & answer) for a technically suitable pressure sensor mean for the purchase.

(10 marks)

Q4 (a) A 3-bits analog to digital converter (ADC) with 40V full scale (FS) indicate 8 as its number of output.

(i) Calculate its transition, resolution, quantization error and percent accuracy.

(6 marks)

(ii) Sketch a graph showing the relationship between digital output and analog input for **Q4 (a)(i)**.

(5 marks)

(b) A filter is defined as a device that passes electrical signals at a certain frequency or frequency range while preventing the passage of others.

(i) Name **FOUR (4)** types of filter described above which are available in the market.

(4 marks)

(ii) Compare each of the filters that you have named in **Q4 (b)(i)** in term of its function.

(4 marks)

(iii) Draw output from ideal filters answered in **Q4 (b)(i)**.

(6 marks)

Q5 (a) A controller is an active element in each control configuration, which receives information from a majoring system and takes the necessary action by changing a value to the set point limit.

(i) Choose and explain **FOUR (4)** reasons why an industrial process needs to be controlled.

(8 marks)

(ii) List **FOUR (4)** types of computer based controller

(4 marks)

(b) A valve is a device that regulates, directs or control the flow of a fluid by opening, closing or partially obstructing various passageways.

(i) State **THREE (3)** categories of a globe valve

(3 marks)

(ii) Draw a diagram of a ball valve complete with its label.

(3 marks)

(iii) Select a valve size that will operate properly for the following condition:
(*use the following data in **Table Q5(b)(iii)***)

- Flow rate of 350 gal/min
- Ethyl alcohol (specific gravity = 0.8)
- Pressure drop across valve expected to be 100 psi

Table Q5(b)(iii): Control valve flow coefficient

Valve Size (inches)	C_v
¼	0.3
½	3
1	14
3/2	35
2	55
3	108
4	174
6	400
8	725

(4 marks)

(c) There are three (3) types of DC motor namely series, shunt and compound. Describe unique features for each type of the DC motor.

(3 marks)

-END OF QUESTIONS-