



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022**

COURSE NAME : PROCESS INSTRUMENTATION
COURSE CODE : BNQ 30304
PROGRAMME : BNN
DATE : JULY 2022
DURATION : 3 HOURS
INSTRUCTION : 1. ANSWER ALL QUESTIONS
2. THIS FINAL EXAMINATION IS
CONDUCTED VIA **CLOSED BOOK**.
3. STUDENTS ARE **PROHIBITED** TO
CONSULT THEIR OWN MATERIAL OR
ANY EXTERNAL RESOURCES DURING
THE EXAMINATION CONDUCTED VIA
CLOSED BOOK

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THIS PAPER CONSISTS OF FIVE (5) PAGES ONLY

Q1 (a) (i) Differentiate between static and dynamic instrumentation characteristics with **TWO (2)** examples each. (4 marks)

(ii) Define the term '*accuracy*', '*range of span*' and '*drift*'. (6 marks)

(b) The output of an iron-constant thermocouple is shown in **Table Q1 (b)**:

Table Q1(b)

Input (°C)	Output (mV)
0	0
150	300
300	600
450	900
600	1200

Based on the data obtained from **Table Q1(b)**;

(i) draw an output versus input graph in the given graph paper. (3 marks)

(ii) determine the overall measuring system sensitivity if the thermocouple is link with amplifier gain of 2.0 V/mV and recorder with a sensitivity of 5.0 mm/V. (3 marks)

(c) (i) Describe the term '*instrumentation system*'. Your description should include definition, form and advantage. (4 marks)

(ii) Draw a flow chart consisting of a basic measurement system complete with labels. The flow chart must begin with a measurand and end with a display unit. Explain the operation of the flow chart in **ONE (1)** sentence. (5 marks)

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Q2 (a) An analog to digital converter (ADC) for UTHM has a transition number of 7.

(i) Calculate the number of output bits for the UTHM ADC converter
(2 marks)

(ii) With the aid of a diagram, illustrate the relationship between digital output code and analog input signal for UTHM ADC converter.
(3 marks)

(iii) UTHM change their current ADC converter to a new 4 bytes ADC converter with ± 0.5 byte of quantization error and 10 volt of input full scale voltage.

Determine: (a) Resolution;

(b) quantization error in volt and;

(c) accuracy percentage (full scale) of the new instrument.

(6 marks)

(b) (i) Define the term '*Filter*' and '*Filtering Process*'

(2 marks)

(ii) Differentiate between '*Band-pass filter*' and '*Band-stop filter*' in term of purpose and output from each ideal filter. Show your answers in a table form with output in a diagram form.

(8 marks)

(iii) Interpret the meaning of '*Transmission*' and '*Attenuation*' in filtering process.

(4 marks)

Q3 (a) (i) Name **SIX (6)** criteria that are required to be considered when selecting a transducer or a sensor.

(3 marks)

(ii) Pressure sensors can be divided into a few types but the most common are deflection, strain gauge and piezoelectric. Differentiate these **THREE (3)** types of pressure sensors in term of each principal operation respectively.

(9 marks)

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- (b) A simple Ramp ADC is using a counter operation and it is considered slow as it needs longer time if the number of bits increased. Formulate the conversion process using analog to digital simple ramp converter via the counter operation if an analog input of 5 V is supplied. It is advisable to answer in a tabulated form.

(5 marks)

- (c) Differentiate between ‘*Supervisory Digital Control (SDC)*’ and ‘*Distributed Digital Control (DiDC)*’ in term of its operating procedure.

(3 mark)

- (d) Explain the term ‘*noise*’ and its types together with an example for each type.

(5 marks)

- Q4** (a) “The operation of a generator is based on Faraday’s Law where the voltage will be induced when the conductor passes through a magnet flux”.

- (i) With an aid of a few diagrams, illustrate the operation of basic DC generator for one complete cycle of induced voltage complete with label and brief description

(8 marks)

- (ii) Sketch a graph for voltage versus angular position drawn in question **Q4 (a) (i)** for **THREE (3)** complete rotation.

(2 marks)

- (b) A control valve is a valve used to control fluid flow by varying the size of the flow passage as directed by a signal from a controller.

- (i) There are **TWO (2)** basic types of valves. Name and describe the characteristics for each type.

(4 marks)

- (ii) Name **TWO (2)** basic design of valve.

(2 marks)

- (c) (i) Define the term ‘*actuator*’.



(3 marks)

- (ii) Two types of existing motor/generator namely are direct current (DC) motor and alternate current (AC) motor.

Name and describe the characteristics of all **THREE (3)** types of DC motor.

(6 marks)

-END OF QUESTIONS-

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