Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	INSTRUMENTATION AND CONTROL
COURSE CODE	:	BNR 20703
PROGRAMME CODE	:	BND / BNF
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Explain the terms listed below when applied to a measurement system:

(i) Precision.

(2 marks)

(ii) Accuracy

(2 marks)

(b) The output voltage of an amplifier was measured by six different students using the same oscilloscope with the following results: 20.20 V, 19.90 V, 20.05 V, 20.10 V, 19.85 V, and 20.00 V. Calculate the most precise measurement.

(5 marks)

(c) An 820 Ω ±10% resistance, R carries a current of 10 mA. The current was measured by an analog ammeter on a 25 mA range with an accuracy of ±2% of full scale.

(i) State the error of resistance, R in percentage.

(2 marks)

(ii) Calculate the error of current, I in percentage.

(6 marks)

(iii) Calculate total power dissipated in the resistor

(3 marks)

Q2 (a) State **TWO (2)** important characteristics that needed for any physical devices to be defined as a good standard reference.

(2 marks)

(b) Differentiate **TWO (2)** characteristics between international standard, primary standard, secondary standard and working standard.

(8 marks)

(c) State the definition of the mass and the temperature according to the international standard.

(2 marks)

(d) Calculate the dimension of a and b for the equation for the change of position of the train starting at $x = 0$ m is given by $x = 5at^2 + bt^4$.

(6 marks)

(e) State **TWO (2)** reasons for having an instrument calibrated.

(2 marks)

Q3 (a) With the aid of diagram, differentiate between voltmeter, ammeter and ohmmeter in term of their measurement circuit connection.

(6 marks)

(b) Measurement of the current, I flowing through a resistor and the corresponding voltage drop, V are shown in **Table Q3 (b).**

(i) In graph paper, plot the characteristic of current against voltage.

(6 marks)

(ii) Determine the value of the resistor from the data measured.

(4 marks)

(iii) Determine the sensitivity of the current against voltage.

(2 marks)

(c) Suggest how the measurement error can be reduced.

(2 marks)

Q4 (a) Elaborate the function of Oscilloscope.

(2 marks)

(b) Measurement of signal in oscilloscope can be conducted using cursor button and measure button.

(i) Elaborate both procedures in taking the measurement.

(4 marks)

(ii) If two signals are measured in a same oscilloscope at the same time, describe the steps required to obtain the phase difference between them using cursor and calculation theory.

(7 marks)

(c) A signal has an equation, $v(t) = 5.5\ cos(50t + 12)$. Determine:

(i) The period

(3 marks)

(ii) The frequency

(2 marks)

(iii) The *rms* value

(2 marks)

Q5 (a) The unknown resistance R_u of a resistance thermometer is measured by a deflection type bridge circuit of the form shown in **Figure Q5 (a)**, where R_1 is 100 Ω, R_2 is 1000 Ω , R_3 is 1000 Ω and V_i is 20 V. The thermometer has a resistance of 100 Ω at 0 °C and the resistance varies with temperature at the rate of 0.4 Ω / °C for small temperature changes around 0 °C.

(i) Calculate the bridge sensitivity in units of volts/ohm.

(7 marks)

(ii) Calculate the sensitivity of the total measurement system in units of volts/°C for small-temperature changes around 0 °C.

(3 marks)

(b) According to Merriam-Webster's dictionary, sensor can be defined as a device that responds to a physical stimulus and transmits a resulting impulse.

(i) State **THREE (3)** type of sensors that available in the market.

(3 marks)

(ii) With the aid of diagram, elaborate how infra-red sensor can be used to measure the length of an object.

(7 marks)

- END OF QUESTIONS –

FINAL EXAMINATION

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COURSE NAME	:	MEASUREMENT AND INSTRUMENTATION	COURSE CODE	:	BNR 27302

Table Q3 (b)

I (Ampere)	1	2	3	4	5
V (Volt)	10.8	20.4	30.7	40.5	50.0

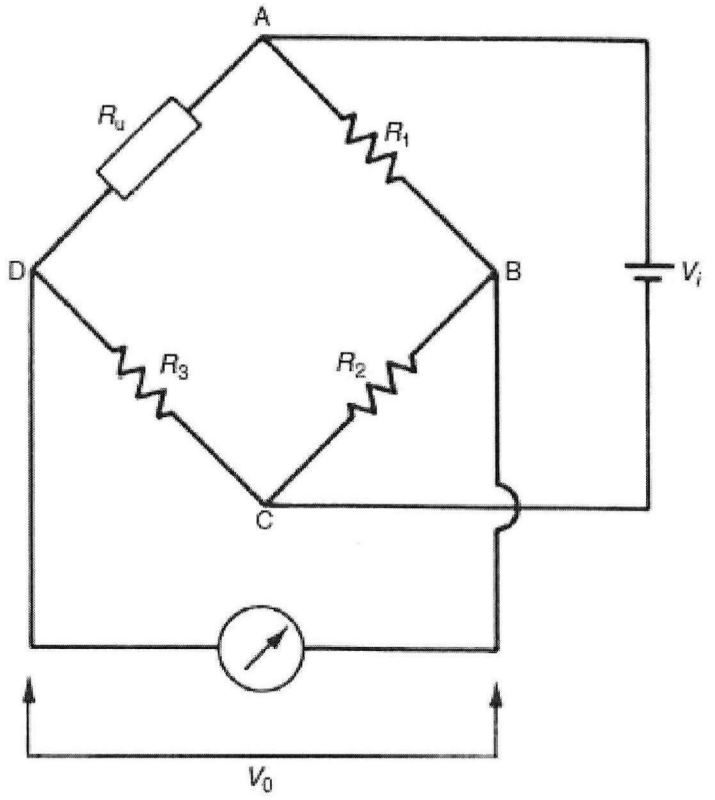

Figure Q5 (a)