Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER III
SESSION 2018/2019

COURSE NAME	:	ELECTRICAL INSTRUMENTATION AND MEASUREMENT
COURSE CODE	:	DAE 21403
PROGRAMME CODE	:	DAE
EXAMINATION DATE	:	AUGUST 2019
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWERS **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1

(a) Name type of errors for each of the following statements:-

(i) f = 100 Hz ± 5 Hz
(ii) an instrument using low quality of components
(iii) wrong method of measurement

(3 marks)

(b) State the purpose to find the mean value when doing a lot of measurements using an old instruments.

(2 marks)

(c) State the difference between accuracy and precision.

(4 marks)

(d) Give **two (2)** reasons why there are differences between theoretical values and practical values.

(4 marks)

(e) Give **two (2)** reasons why an accuracy is very important for the radar system onboard a naval ship for the military operation at sea.

(4 marks)

(f) Give **two (2)** disadvantages if the accuracy of the radar system in **Q1(e)** is poor.

(4 marks)

(g) State the relationship between quality of instrument, accuracy, cost and quality of results.

(4 marks)

Q2

(a) Sketch the construction of a permanent Magnet Moving Coil (PMMC) meter movement. Label your sketching that indicate Permanent Magnet, Scale, Control Spring, Pointer and Moving Coil.

(6 marks)

(b) State the main reason why are Permanent Magnet Moving Coil (PMMC) instruments being classified as deflection instrument.

(3 marks)

(c) List **four (4)** precaution during handling and taking measurement of a multirange Voltmeter.

(4 marks)

(d) Based on the **Figure Q2(c)**, a PMMC instruments has a three resistor Ayrton shunt connected across it to make an ammeter. The resistance values are R1 = 0.05Ω, R2 = 0.45Ω and R3 = 4.5Ω. The meter has Rm = 1k Ω and FSD = 50μA. Calculate the three ranges of the ammeter.

(12 marks)

Q3

(a) Based on Wheatstone bridge in **Figure Q3(a)**, the resistive components have following nominal values:
V = 5 V, R_1= 1 kΩ, R_2= 1.5 kΩ, R_3= 3.9 kΩ and R_4= 7.5 kΩ,

(i) Calculate V_{TH} and R_{TH}
(ii) Draw the equivalent circuit of Thevenin.
(iii) The Galvanometer has a current sensitivity of 20 mm/μA and internal resistance of 75 Ω. Calculate the deflection of the Galvanometer.

(12 marks)

(b) A Maxwell bridge is designed to measure the unknown impedance (R_x, L_x) of a coil, is shown in **Figure Q3(b)**.

(i) Derive an expression for R_x and L_x under balance conditions.
(ii) If the fixed bridge component values are R_2=100 Ω and C_1=20 μF, calculate the value of the unknown impedance, R_x and L_x if R_1=3183 Ω and R_3=50 Ω at balance.

(10 marks)

(c) State **two (2)** conditions that must be met simultaneously when balancing an AC bridge.

(3 marks)

Q4

(a) List **four (4)** measurements that can be performed using an oscilloscope.

(4 marks)

(b) Describe the **four (4)** basic control functions of an oscilloscope.

(8 marks)

(c) The waveform shown in **Figure Q4(c)** is observed on the CRT screen. If the Time/Div switch is set to 5 μsec and the Volts/Div switch is set to 0.1 V, determine ,

(i) Peak-to-peak voltage amplitude, VP-P
(ii) Period for one cycle, T
(iii) Frequency, f

(6 marks)

(d) Two sine waves of the same phase and amplitude are applied to the input terminals of an oscilloscope operating in the X-Y mode. If the signal applied to the vertical input is twice the frequency of the horizontal input signal, sketch the waveform that will be observed on the oscilloscope screen.

(3 marks)

(e) Name **two (2)** types of signal generator and **describe** its difference.

(4 marks)

Q5

(a) Name type of sensor used in rice cooker and electric kettle.

(2 marks)

(b) Briefly explain the operating principles of an infrared sensor.

(5 marks)

(c) Give **two (2)** examples of applications for each of the following sensors or transducers:

(i) light sensor
(ii) velocity sensor
(iii) pressure transducer
(iv) sound transducer

(8 marks)

(d) Give **two (2)** reasons why the sensory system is very useful and helpful in chemical and gas industries.

(4 marks)

(e) Give **three (3)** opinions why the application of sensors is very important in modern industries.

(6 marks)

-END OF QUESTIONS –

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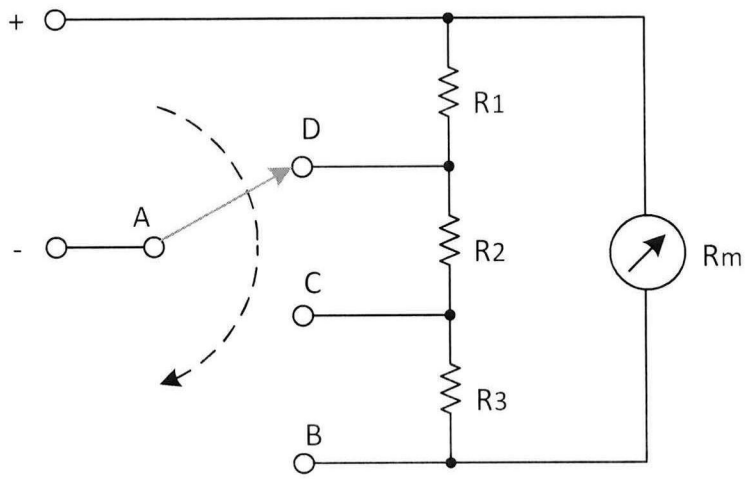

Figure Q2 (c)

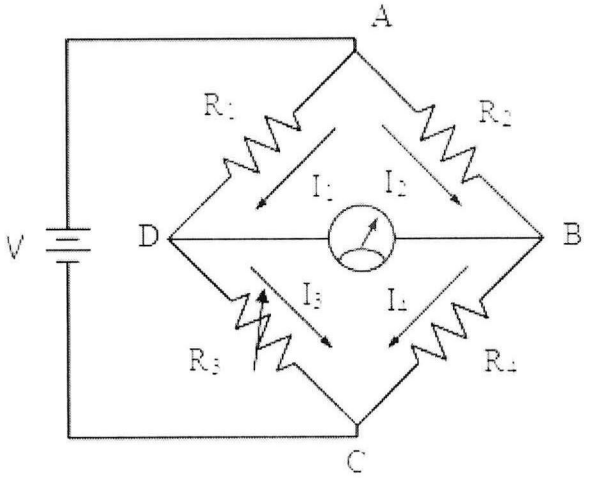

Figure Q3 (a)

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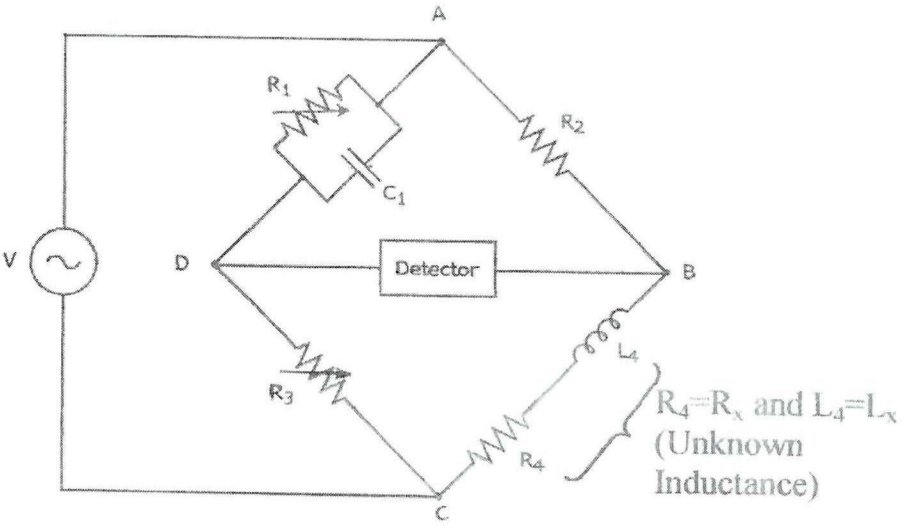

Figure Q3 (b)

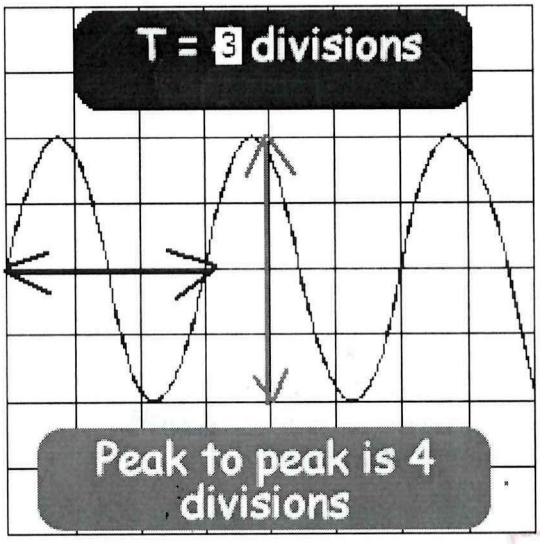

Figure Q4 (c)