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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2015/2016

COURSE NAME : ELECTRICAL MEASUREMENT AND INSTRUMENTATION

COURSE CODE : DAE 21402

PROGRAMME : 2 DAE

EXAMINATION DATE : DECEMBER 2015/JANUARY 2016

DURATION : 2 HOURS 30 MINUTES

INSTRUCTION : ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

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Q1 (a) List **four (4)** sources of possible errors in instruments.

(4 marks)

(b) The following values were obtained from the measurements of the value of a resistor;

| 147.2 Ω | 147.4 Ω | 147.9 Ω | 148.1 Ω | 147.1 Ω |
| 147.5 Ω | 147.6 Ω | 147.4 Ω | 147.6 Ω | 147.5 Ω |

Calculate ;
(i) the arithmetic mean,
(ii) the standard deviation,
(iii) the probable error, of the average of the ten readings.

(6 marks)

(c) Draw and label the block diagram of an electronic measuring system and give the function of each component in that system.

(8 marks)

(d) For the circuit shown in **Figure Q1(d)**, a current meter with an internal resistance of 120 Ω is used to measure the current through resistor, R_s. Determine the percentage error of the reading due to ammeter insertion.

(7 marks)

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Q2 (a) For Wheatstone bridge and Wien bridge ;

(i) draw the basic bridge circuit and label each component accordingly.

(3 marks)

(ii) state the function of each bridge.

(3 marks)

(b) An AC bridge is balanced at 1000 Hz and has the following constants:

Arm AB - 0.2 μF pure capacitance
Arm BC - 500 Ω pure resistance
Arm CD - unknown
Arm DA - $R = 600$ Ω in parallel with $C = 0.1$ μF

The supply is connected between A and C while the galvanometer is connected between D and B.

(i) Illustrate that AC bridge.

(2 marks)

(ii) Derive the balance condition.

(6 marks)

(iii) Find the R and C or L constants of arm CD, considered as a series circuit.

(10 marks)

(iv) State the function of galvanometer in that AC bridge.

(1 mark)

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Q3 (a) Differentiate between analog and digital oscilloscope in terms of its function.

(3 marks)

(b) There are **four (4)** basic control function of an oscilloscope. Describe each function clearly.

(6 marks)

(c) **Figure Q3 (c)** shows a trace on the screen of an oscilloscope. The Y-axis of the oscilloscope is set as voltage in milivolt (mV) and the X-axis is set as time in second (s). For the trace, determine

(i) the maximum positive value and the maximum negative value of the signal.

(2 marks)

(ii) the frequency of the signal

(2 marks)

(iii) unit per division representation for both X-axis and Y-axis.

(2 marks)

(d) A Lissajous pattern on an oscilloscope is shown in **Figure Q3 (d)**. If the frequency of horizontal input for both pattern is 1000 Hz, determine the frequency of vertical input for each pattern.

(5 marks)

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

(5 marks)

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Q4 (a) Name and describe (with the help of diagrams) a sensor used to measure the following quantity:

(i) Light

(3 marks)

(ii) Sound

(3 marks)

(b) State the function of transducer and explain its importance in electronic measurements.

(6 marks)

(c) The circuit in **Figure Q4 (c)(i)** is to be used for temperature measurement. A "15 kΩ" thermistor as shown in **Figure Q4 (c)(ii)** is used. The meter is a 2-mA ammeter with a resistance of 1800 Ω. R_C is set to 8 kΩ and the supply voltage V_T is 10 V. What will be the meter readings at 50 °F and at 300°F?

(9 marks)

(d) A strain gauge having a gauge factor of 4 is used in testing a machine. If the gauge resistance is 90 Ω and the strain is 2×10^{-5}, how much will the resistance of the strain gauge change?

(4 marks)

- END OF QUESTION -

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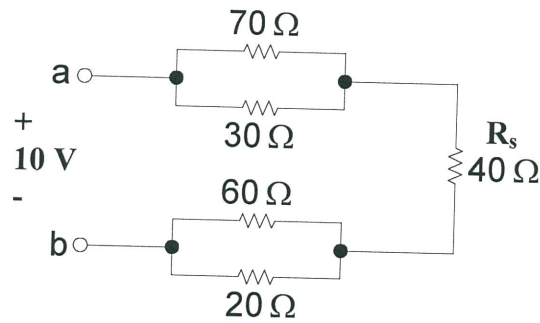
FIGURE Q1 (d)

FIGURE Q3 (c)

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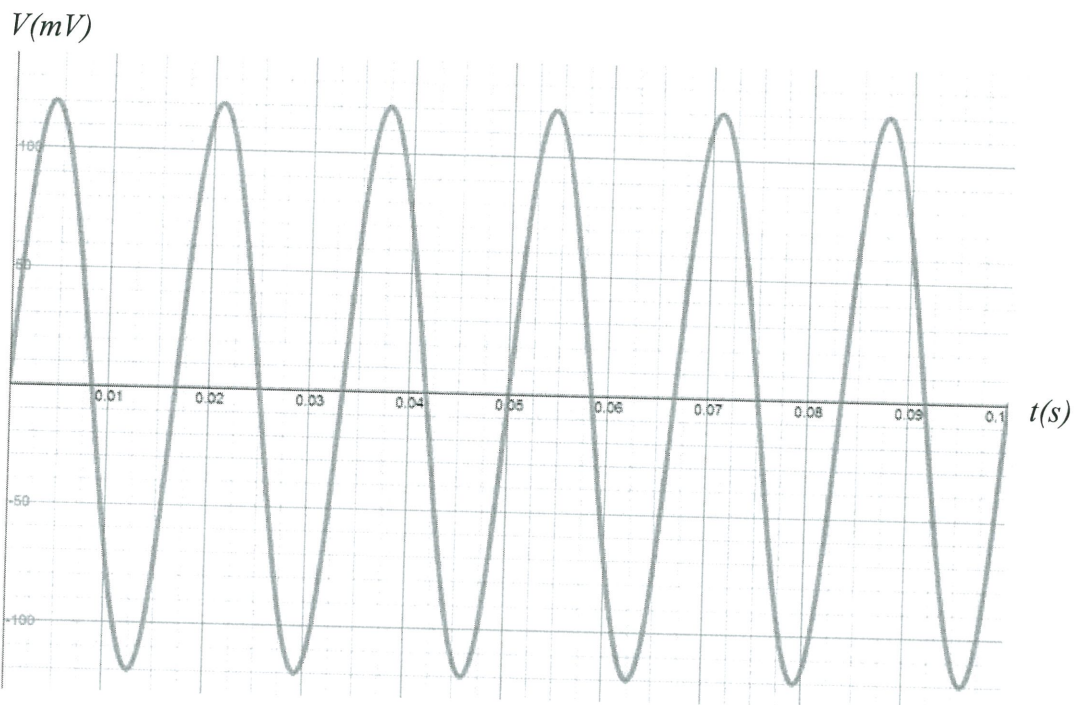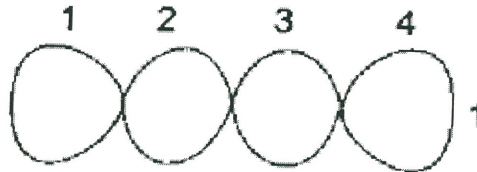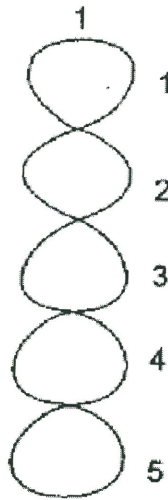| FINAL EXAMINATION	
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(i)

(ii)

FIGURE Q3 (d)

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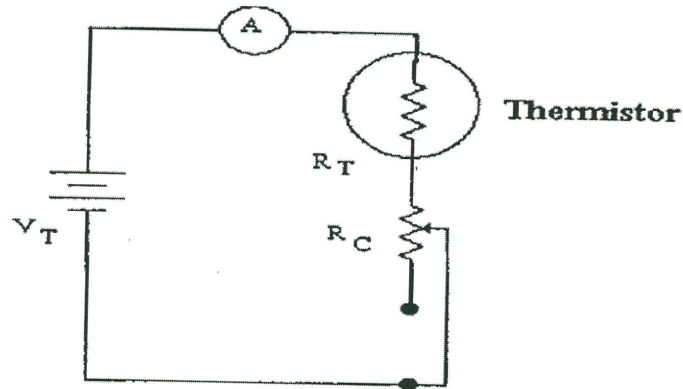
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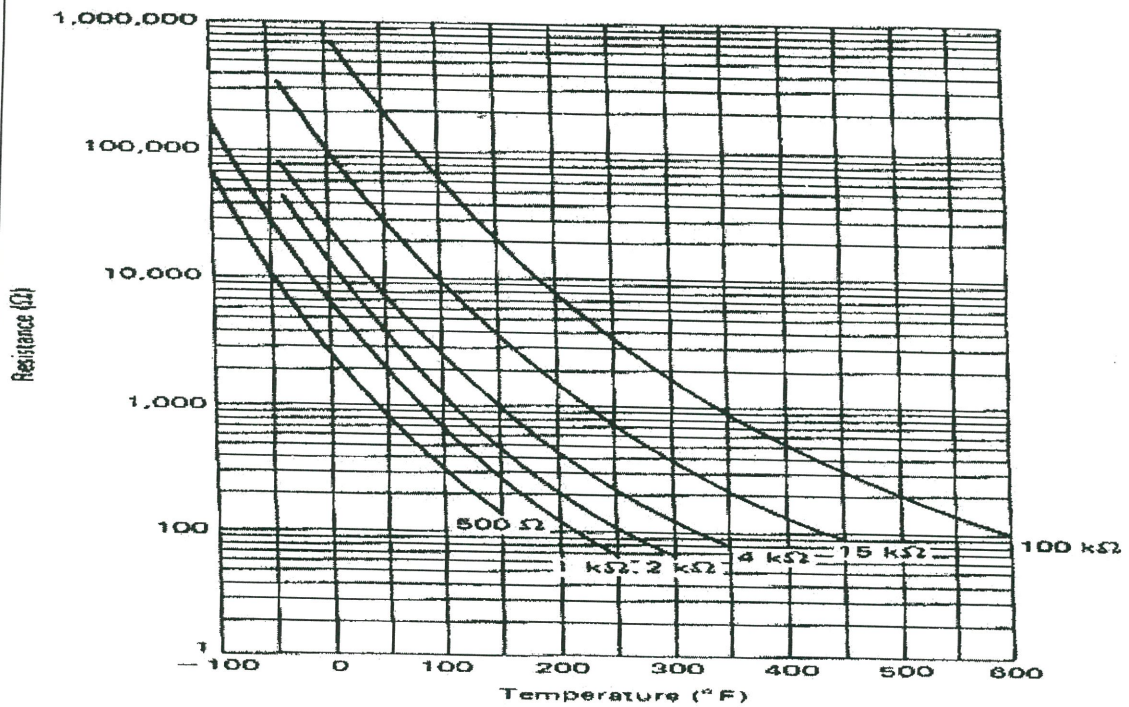COURSE CODE: DAE 21402

FIGURE 4 (c) (i)

FIGURE 4 (c) (ii)