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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2010 SESSION

SUBJECT CODE	:	FLD 10202
SUBJECT TITLE	:	INSTRUMENTATION
LEVEL	:	DIPLOMA
TIME / DURATION	:	12.30pm – 2.30pm (2 HOURS)
DATE	:	08 MAY 2010

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This questions paper consists of TWO (2) sections. Section A and B. Answer ALL questions in section A. For sections B, answer TWO (2) questions only.
6. Answer all questions in English.

THERE ARE 5 PAGES OF QUESTIONS AND 1 PAGE OF APPENDIX, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

(a) Define the exact difference between accuracy and precision.

(4 marks)

(b) **Figure 1** shows the resistive circuit, determine:

i. The value of V_1 (using voltmeter sensitivity 1kΩ / volt)
ii. The value of V_2 (using voltmeter sensitivity 2kΩ / volt)

(6 marks)

(c) Analysis your answers according to part b(i) and b(ii)

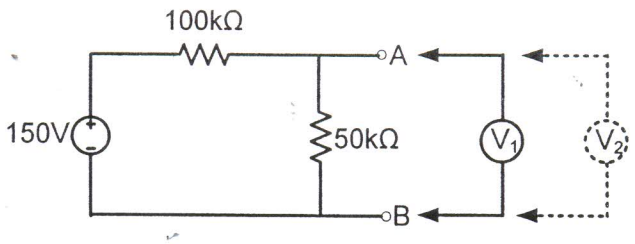

Figure 1

(4 marks)

(d) Three resistances are connected in series and have the following ratings:

$R_1 = 15\Omega \pm 5\%$, $R_2 = 33\Omega \pm 2\%$, $R_3 = 75\Omega \pm 5\%$.

Determine:

i. The magnitude and limiting error in ohms
ii. The percentage relative limiting error

(6 marks)

Question 2

(a) In a survey of 12 owners of certain models of car, the following figures for average petrol consumption were reported.

29.6, 32.4, 39.4, 28.9, 30.0, 33.3, 31.4, 29.5, 30.5, 31.7, 33.0, 29.2

Determine:

i. the arithmetic mean
ii. the deviation of each value
iii. the average deviation for the data
iv. the standard deviation for the data
v. the precision of the 3rd and 9th measurement, and compare which reading most precise.

(14 marks)

(b) A constant uniform deviation of the operation of an instrument is known as a systematic error. There are three types. List and explain each type.

(6 marks)

Question 3

(a) State the various measurements possible on oscilloscope.

(2 marks)

(b) The various front panel control of simple oscilloscope can be divided into three categories:

i. **Basic controls**: On-Off, Focus and Intensity
ii. **Vertical Section**: Vertical scale, DC, AC, Ground and Position
iii. **Horizontal section:** Time base control, position

Based on the above front panel control categories, explain the function of the intensity, vertical scale and time base control.

(6 marks)

(c) In an experiment, the voltage across a 15 kΩ resistor is applied to oscilloscope The screen shows a sinusoidal signal of total vertical occupancy 4 cm and total horizontal occupancy of 4 cm. The front-panel controls of V/div and time/div are on 5V/div and 2 ms/div respectively. Based on the information given:

i. Draw the waveform on the oscilloscope screen shown in **Figure 3**.
ii. Calculate the effective value of the sinusoidal waveform V_{rms}.
iii. Calculate its frequency.
iv. Determine the mathematical expression for the sinusoidal voltage as a function of time.

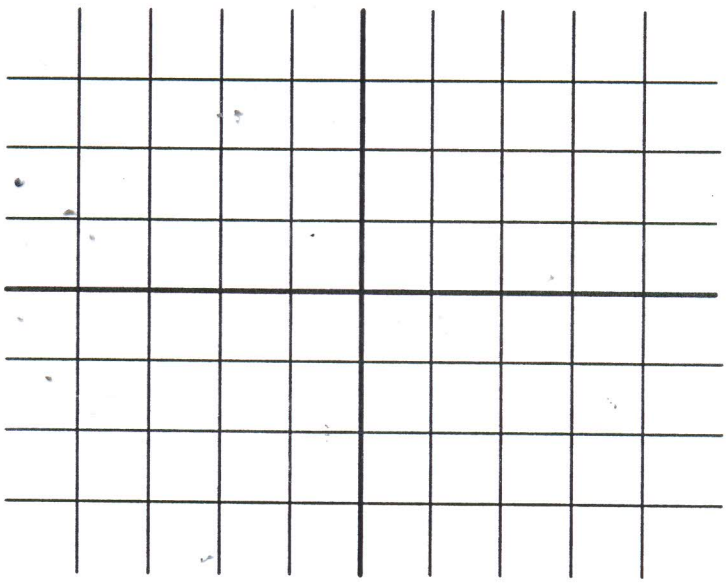

Figure 3

(12 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer only TWO (2) questions.
Please use the answer booklet provided.

Question 1

A basic D'Arsonval meter has an internal resistance of 60Ω and a full scale deflection of 3mA.

(a) Convert the meter above into a multirange dc voltmeter with voltage range of 0 – 10 V, 0 – 50 V, 0 – 100 V and 0 – 250 V and draw the circuit

(5 marks)

(b) Calculate the values of multiplier for each range.

(15 marks)

Question 2

A D'Arsonval movement with an internal resistance of 100Ω and full scale current of 50μA is used.

(a) Design an Aryton shunt to provide an ammeter with a current range of 0 – 1 mA, 0 – 10 mA, 0 – 50 mA and 0 – 100 mA.

(15 marks)

(b) Draw the circuit of the multirange ammeter in part (a).

(5 marks)

Question 3

(a) An unbalanced Wheatstone bridge is given in **Figure 2**. Calculate the current through the galvanometer.

(15 marks)

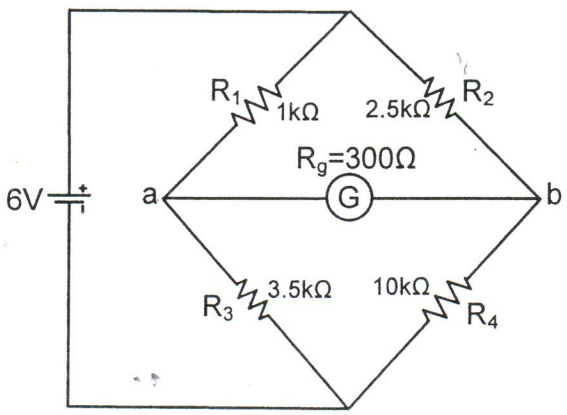

Figure2

(b) List two major applications of the Wheatstone's bridge and explain in detail for each application.

(5 marks)

END OF QUESTION PAPER

APPENDIX

FORMULA

1. $V_p = (\sqrt{2})(V_{rms})$

2. $\bar{x} = \dfrac{x_1 + x_2 + \ldots\ldots + x_n}{n}$

3. $d_n = x_n - \bar{x}$

4. $D_{av} = \dfrac{|d_1| + \ldots\ldots + |d_n|}{n}$

5. $\sigma = \sqrt{\dfrac{d_1^2 + d_2^2 + \ldots\ldots + d_n^2}{n-1}}$

6. $\text{Pr}ecision = 1 - \left|\dfrac{X_n - \overline{X_n}}{X_n}\right|$

7. $\tau_d = BxAxNxI$

8. $\tau_c = K\theta$

9. $A = 1 - \left|\dfrac{Y_n - X_n}{Y_n}\right|$

10. *Aryton Shunt Formula:* $I_{sh}R_{sh} = I_m R_m$

11. *Series Type Ohmmeter Formula:* $R_1 = R_h - \dfrac{I_{fsd}xR_mxR_h}{V}$ *and*

$$R_2 = \frac{I_{fsd}xR_mxR_h}{V - (I_{fsd}xR_h)}$$

12. *Wien Bridge Formula:* $\dfrac{R_2}{R_4} = \dfrac{R_1}{R_3} + \dfrac{C_3}{C_1}$ *and* $\dfrac{1}{\omega C_1 R_3} = \omega C_3 R_1$