Document No : UniKL MFI_SD_AC41
Revision No: 02
Effective Date: 01 December 2008

CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2014 SESSION

SUBJECT CODE	:	**FLD10202**
SUBJECT TITLE	:	**INSTRUMENTATION**
LEVEL	:	**DIPLOMA**
TIME / DURATION	:	**12.45 PM – 2.45 PM (2 HOURS)**
DATE	:	**6 JANUARY 2015**

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. **Answers should be written in blue or black ink except for sketching, graphic and illustration.**
5. **This question paper consists of TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer two (2) questions only.**
6. **Answer all questions in English.**

THERE ARE 8 PAGES OF QUESTIONS, EXCLUDING THIS PAGE AND APPENDIX.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

(a) List out **four (4)** static characteristics that show the performance of an instrument. (4 marks)

(b) State the **three (3)** categories of systematic error and give one example of each. (6 marks)

(c) A voltmeter reads 110V. The error taken from an error curve is 5%. Determine:

(i) The true value (expected value) of the voltage. (4 marks)
(ii) The relative accuracy. (3 marks)
(iii) The % of accuracy. (3 marks)

Question 2

(a) List out the **four (4)** groups of control panel of C.R.O (cathode ray oscilloscope).

(4 marks)

(b) State and draw **three (3)** standard waveforms that can be delivered by a function generator. (6 marks)

(c) In an experiment, a function generator is used to generate a sinusoidal waveform of 1kHz, $8V_{PP}$. An oscilloscope (C.R.O) is used to display the waveform with the vertical scale set to 2V/div and the horizontal scale set to 0.5ms/div respectively.

(i) Draw the waveform on the C.R.O screen shown in **Figure 1**.

(7 marks)

(ii) Calculate the root-mean-square/effective value of the sinusoidal waveform, V_{RMS}.

(3 marks)

Answer for question 2(c)i.

(ATTACH THIS PAPER TOGETHER WITH THE ANSWER BOOKLET)

ID Number:_____

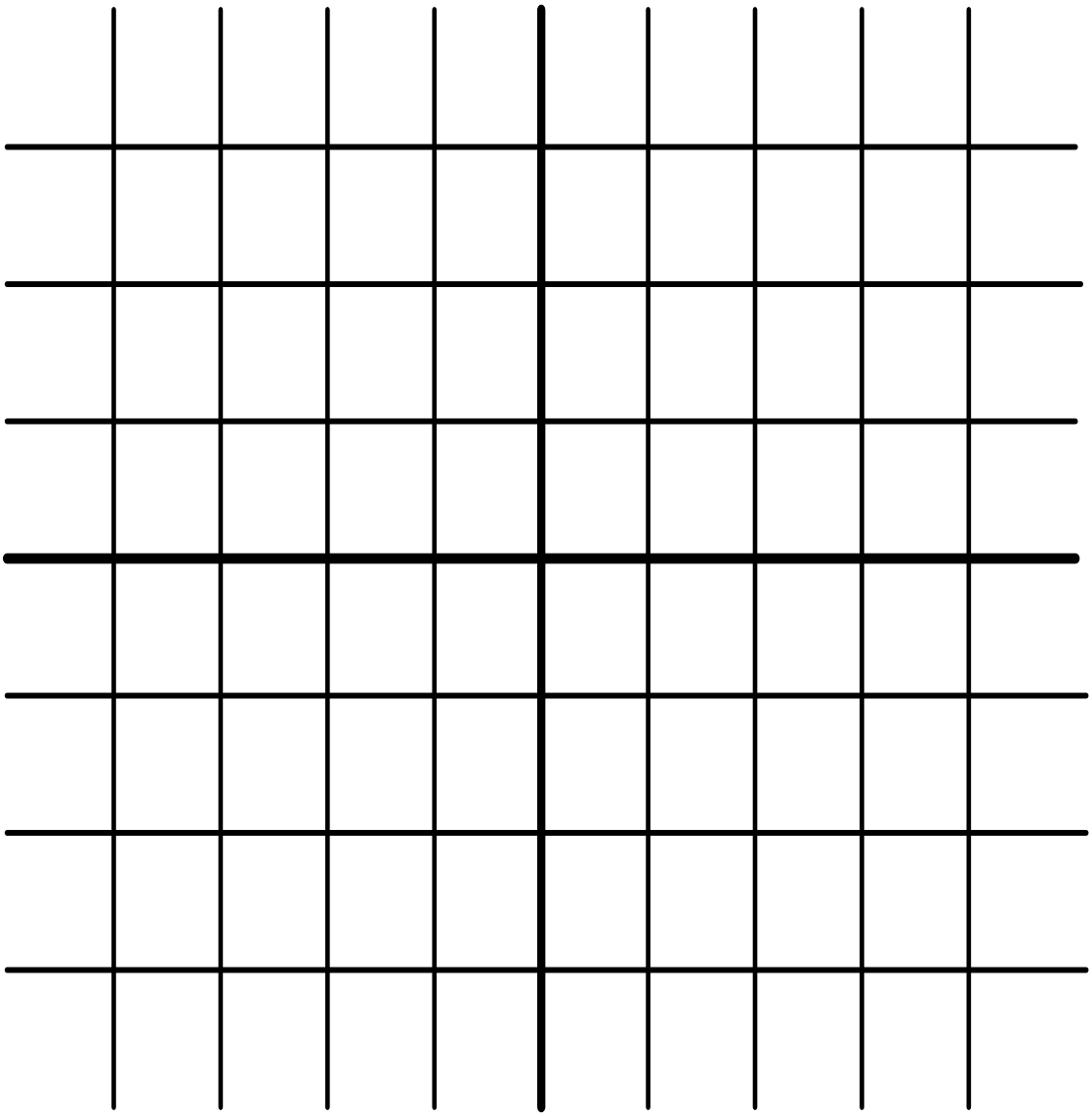

Figure 1

Question 3

(a) **Figure 2** shows a *Permanent Magnet Moving Coil* type of instrument circuit. Based on the figure, answer the following questions.

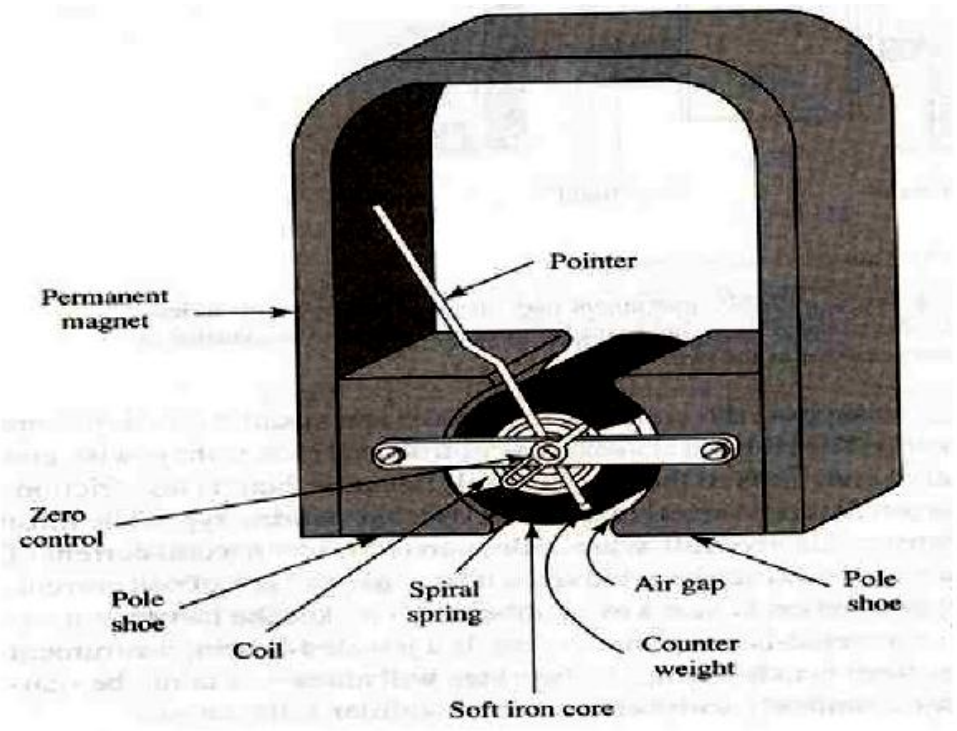

Figure 2

(i) Give another name of this instrument. (1 mark)

(ii) The instrument has the following data:

Number of turns = 150
Width of the coil = 22mm
Length of the coil = 30mm
Flux density in the gap = 0.1Wb/m^2

Calculate the deflecting torque when carrying a current of 15mA and the deflection, if the control spring constant is 2 x 10^{-6}Nm/Degree.

(9 marks)

(b) **Figure 3** shows an *Electrodynamometer*.

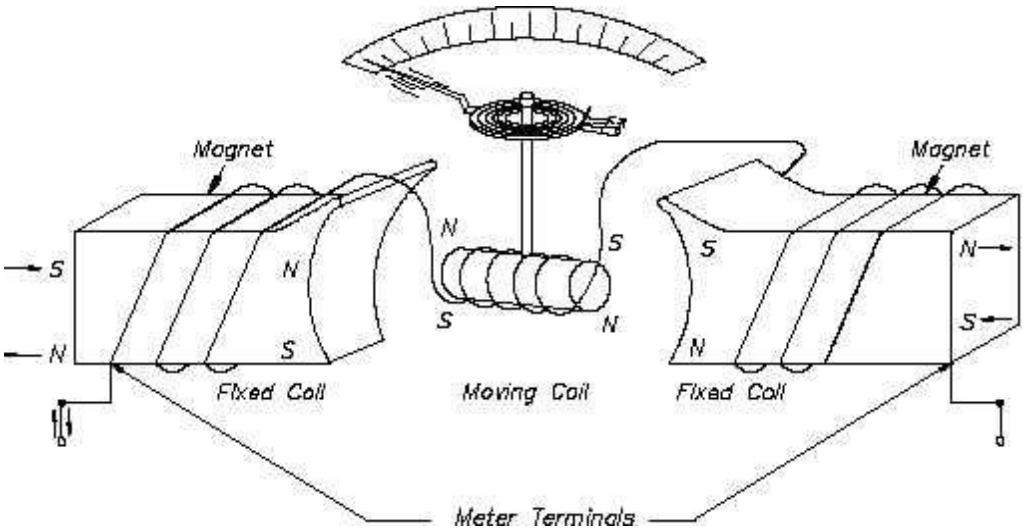

Figure 3

(i) Explain the basic principle of this instrument. (6 marks)

(ii) List out **two (2)** advantages and disadvantages of this instrument. (4 marks)

SECTION B (Total: 40 marks)

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

Question 4

(a) Design a multi-range DC miliammeter with a basic meter having a resistance 70Ω and full scale deflection for the current of 2mA. The required ranges are 0-5 mA, 0-50 mA and 0-100 mA. Your design should provide the following:

(i) The value of shunt resistance for each range.

(8 marks)

(ii) The multi-range miliammeter circuit.

(2 marks)

(b) A basic D'Arsonval movement meter with an internal resistance of 1000Ω and full scale deflection current of 50μA is to be used as a multi-range voltmeter. Design the series string of multipliers to obtain the voltage ranges of 0-5V, 0-50V, 0-100V and 0-250V. (You are required to draw the multi-range voltmeter circuit)

(10 marks)

Question 5

(a) Meter A has a range of 0-100V and multiplier resistance of 20kΩ. Meter B has a range 0-500V and a multiplier resistance of 50kΩ. Both meters have basic meter resistance of 5kΩ. Which meter is more sensitive? Justify your answer.

(5 marks)

(b) A D'Arsonval movement meter having an internal resistance of 100Ω and full scale current of 50μA is used to perform the following measurement as tabulated in **Table 1**:

Table 1

Measured voltage (Volt)	3.15	3.00	2.98	3.05	2.95
Frequency of occurrence	1	2	1	2	2

Determine:

(i) The arithmetic mean. (3 marks)

(ii) The deviation of each value. (4 marks)

(iii) The average deviation for the data. (4 marks)

(iv) The standard deviation for the data. (4 marks)

Question 6

(a) There are **two (2)** types of Bridge circuits; DC bridges and AC bridges. Briefly explain the differences between them.

(4 marks)

(b) List out **two (2)** major applications of the Wheatstone's bridge. (4 marks)

(c) An unbalanced Wheatstone bridge is given in **Figure 4**. Calculate the current through the galvanometer.

(12 marks)

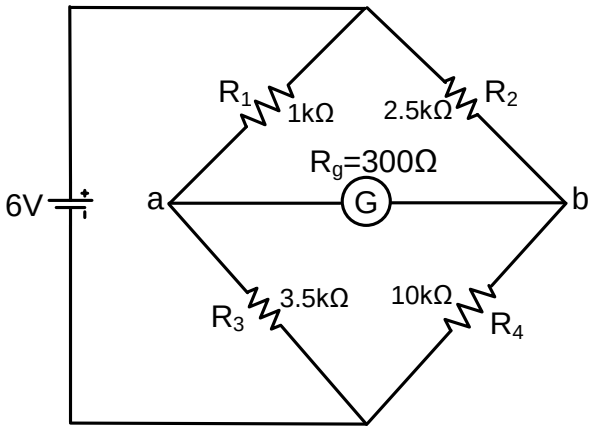

Figure 4

END OF QUESTION PAPER

APPENDIX

FORMULA

1. Absolute error, $e = Y_n - X_n$

2. $\%error = \frac{e}{Y_n} \times 100$

3. Relative Accuracy, $A = 1 - \left| \frac{Y_n - X_n}{Y_n} \right|$

4. Precision $= 1 - \left| \frac{X_n - \overline{X_n}}{\overline{X_n}} \right|$

5. $V_p = \frac{V_{rms}}{0.707}$

6. Arithmetic mean $= \bar{x} = \frac{x_1 + x_2 + ... + x_n}{n}$

7. Deviation, $d_n = x_n - \bar{x}$

8. Average deviation, $D_{av} = \frac{|d_1| + ... + |d_n|}{n}$

9. Standard deviation, $\sigma = \sqrt{\frac{d_1^2 + d_2^2 + ... + d_n^2}{n-1}}$ for n<30

10. Deflecting torque, $\tau_d = BxAxNxI$

11. Deflecting torque, $\tau_d = K\theta$

12. Shunt resistor, $R_{sh} = \frac{I_M \times R_M}{I_{SH}}$

13. Multiplier resistor, $R_S = \frac{V}{I_M} - R_M$

14. Current through galvanometer, $I_G = \frac{E_{TH}}{R_G + R_{TH}}$