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SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2013 SESSION

SUBJECT CODE	:	**FLD 10202**
SUBJECT TITLE	:	**INSTRUMENTATION**
LEVEL	:	**DIPLOMA**
TIME / DURATION	:	**2 HOURS**
DATE	:	

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) State the **three (3)** major categories of error and give one example each.

(6 marks)

(b) The following set of data is obtained from an instrument for a particular measurement.

Table 1

Data	X_1	X_2	X_3	X_4	X_5	X_6
Measured value	30.7	31.1	31.2	30.6	30.7	31.3

Determine:

(i) The arithmetic mean.

(2 marks)

(ii) The deviation of each value.

(6 marks)

(iii) The average deviation for the data.

(3 marks)

(iv) The standard deviation for the data.

(3 marks)

Question 2

(a) State **four (4)** possible measurements that can be performed by using C.R.O (Cathode Ray Oscilloscope).

(4 marks)

(b) List out the **four (4)** groups of front control panel of a C.R.O.

(4 marks)

(c) State **three (3)** standard waveforms that can be delivered by a function generator.

(3 marks)

(d) In an experiment, a function generator is used to generate a sinusoidal waveform of 1 kHz, $14V_{PP}$. 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**.

(6 marks)

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

(3 marks)

Answer for question 2(d)i.

(ATTACH THIS PAPER TOGETHER WITH THE ANSWER BOOKLET)

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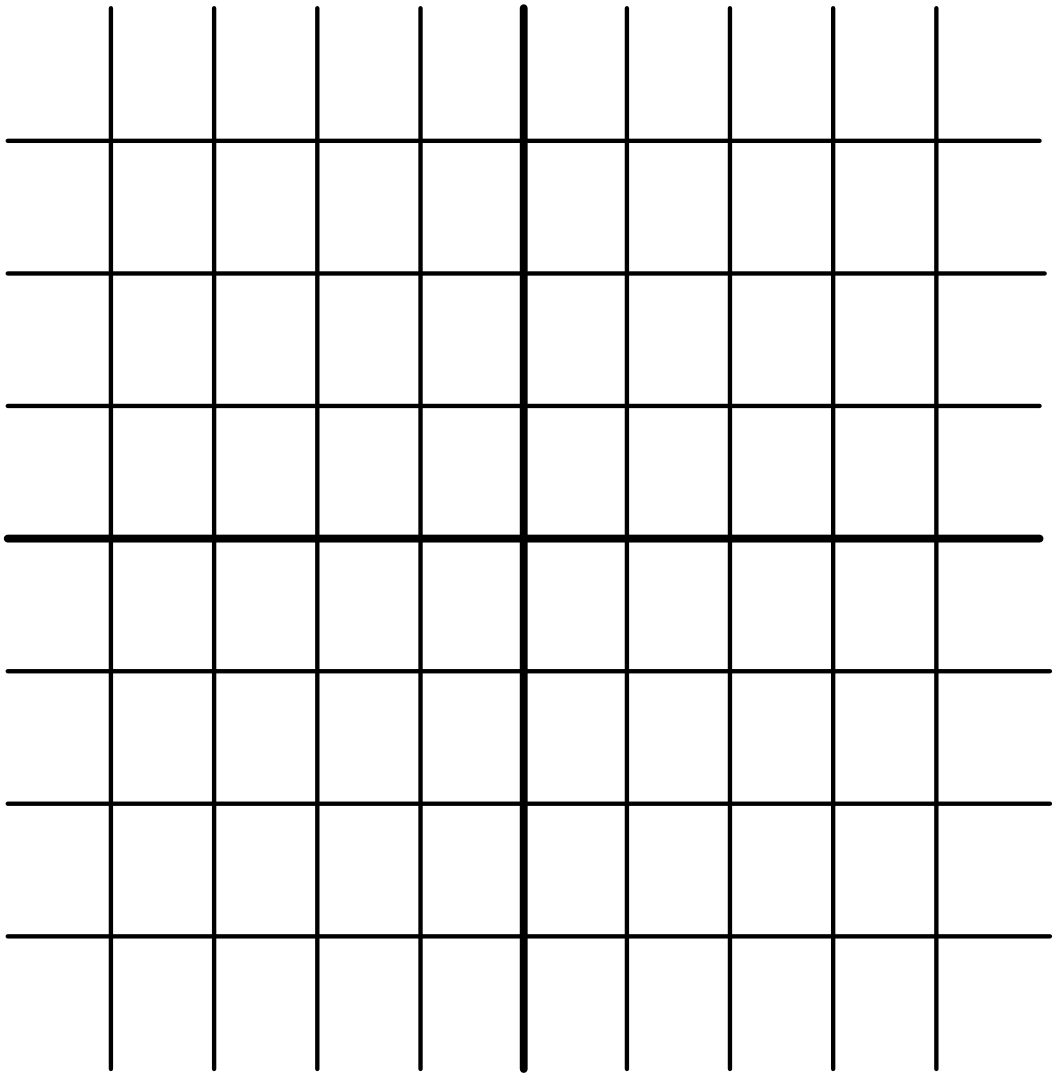

Figure 1

Question 3

(a) **Figure 2** shows an *Electrodynamometer*. Based on **Figure 2**:

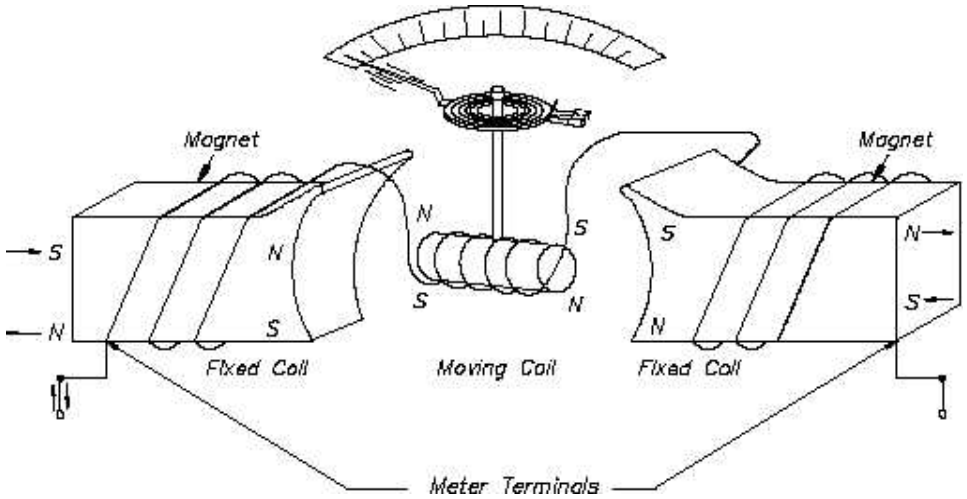

Figure 2

(i) Explain the basic principle of this instrument.

(4 marks)

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

(4 marks)

(b) The following questions refer to the instrument shown in **Figure 3**.

(i) Identify the instrument. (1 mark)

(ii) State **one (1)** difference between this instrument and moving iron types instrument.

(2 marks)

(iii) The instrument has the following data:

Number of turns = 150
Width of the coil = 15mm
Length of the coil = 31mm
Flux density in the gap = 0.2Wb/m^2

Calculate the deflecting torque when carrying a current of 30mA and the deflection, if the control spring constant is 2 x 10^{-6}Nm/Degree.

(9 marks)

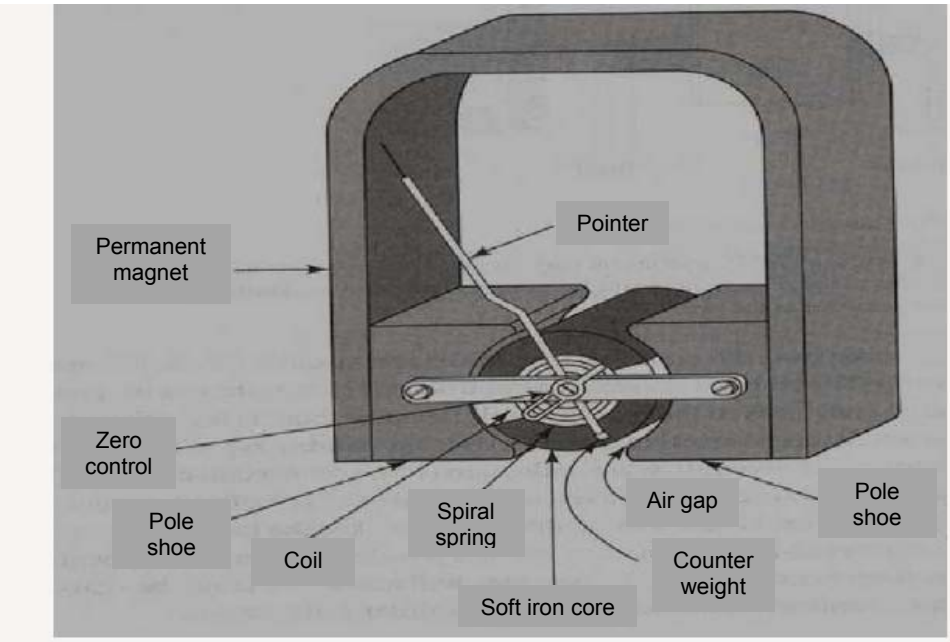

Figure 3

SECTION B (Total: 40 marks)

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

Question 4

(a) Design a multirange DC miliammeter with a basic meter having a resistance 70Ω and full scale deflection for the current of 3mA. The required ranges are 0-10 mA, 0-25 mA and 0-50 mA. Your design should provide the following:

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

(8 marks)

(ii) The multirange miliammeter circuit.

(2 marks)

(b) A basic D'Arsonval movement meter with an internal resistance of 40 Ω and full scale deflection current of 4mA is to be used as a multirange voltmeter. Design the series string of multipliers to obtain the voltage ranges of 0-10V, 0-100V, 0-300V and 0-500V.

(10 marks)

Question 5

(a) Meter A has a range of 0-100V and multiplier resistance of 20kΩ. Meter B has a range 0-1000V and a multiplier resistance of 200kΩ. Both meters have basic meter resistance of 2kΩ. Which meter is more sensitive?

(5 marks)

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

(i) Design an Aryton shunt to provide an ammeter with current ranges of 0 – 1mA, 0-10mA and 0-100mA.

(13 marks)

(ii) Draw the circuit of the Aryton shunt ammeter in part b(i).

(2 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)

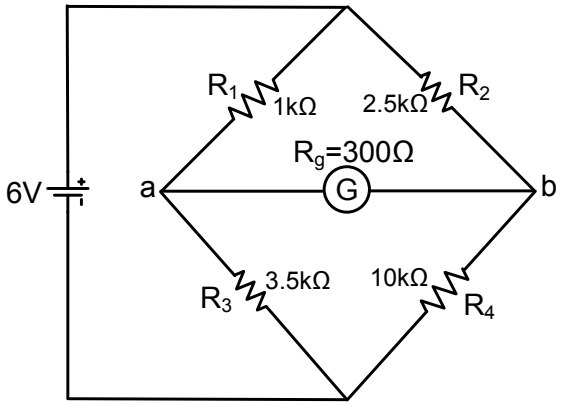

Figure 4

END OF QUESTION PAPER

APPENDIX

FORMULA

1. $V_P = (\sqrt{2})(V_{RMS})$

2. Arithmetic mean, $\bar{x} = \dfrac{x_1 + x_2 + ... + x_n}{n}$

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

4. Average Deviation, $D_{av} = \dfrac{|d_1| + ... + |d_n|}{n}$

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

6. Precision = $1 - \left| \dfrac{X_n - \overline{X_n}}{\overline{X_n}} \right|$

7. Deflecting torque, $\tau_d = BxAxNxI$

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

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

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

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

$$R_2 = \frac{I_{fsd}xR_m xR_h}{V - \left(I_{fsd}xR_h\right)}$$