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SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JANUARY 2014 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) By definition, state the difference between ***instrument*** and ***instrumentation***.

(4 marks)

(b) List out **four (4)** different categories of Standard of Measurement.

(2 marks)

(c) The output voltage of an amplifier was measured at six different intervals using the same digital voltmeter with the following results as tabulated in **Table 1**:

Table 1

Data	X_1	X_2	X_3	X_4	X_5	X_6
Measured value (V)	20.00	19.80	19.85	20.05	20.10	19.90

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) What does X-axis, Y-axis and Z-axis on C.R.O (cathode ray oscilloscope) represents?

(3 marks)

(b) Explain the main function of TRIGGER section of a C.R.O.

(2 marks)

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

(6 marks)

(d) In an experiment, a function generator is used to generate a sinusoidal waveform of 0.5kHz, $10V_{PP}$. 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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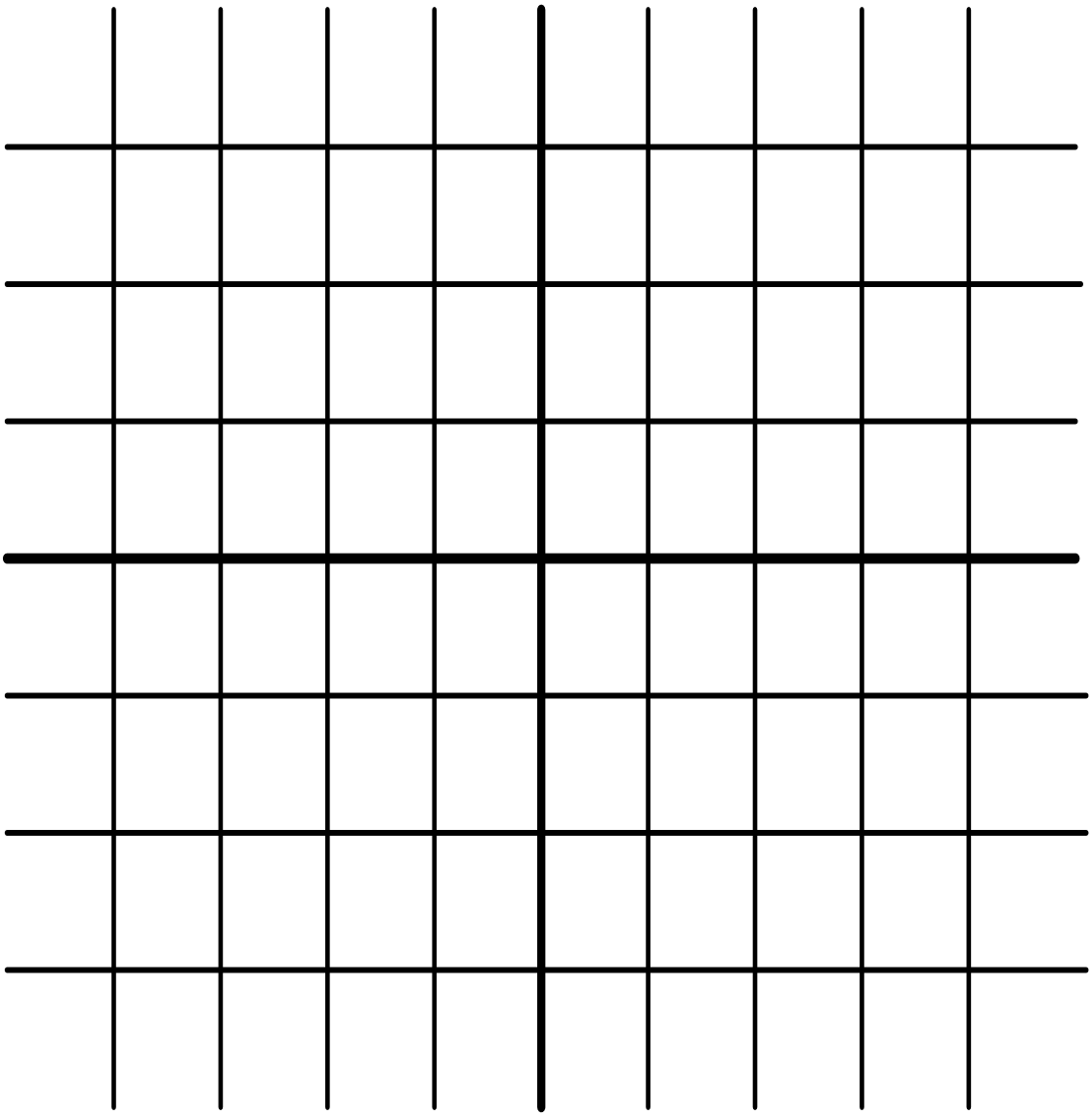

Figure 1

Question 3

(a) **Figure 2** shows a *Moving Iron* type of instrument circuit. Based on **Figure 2**:

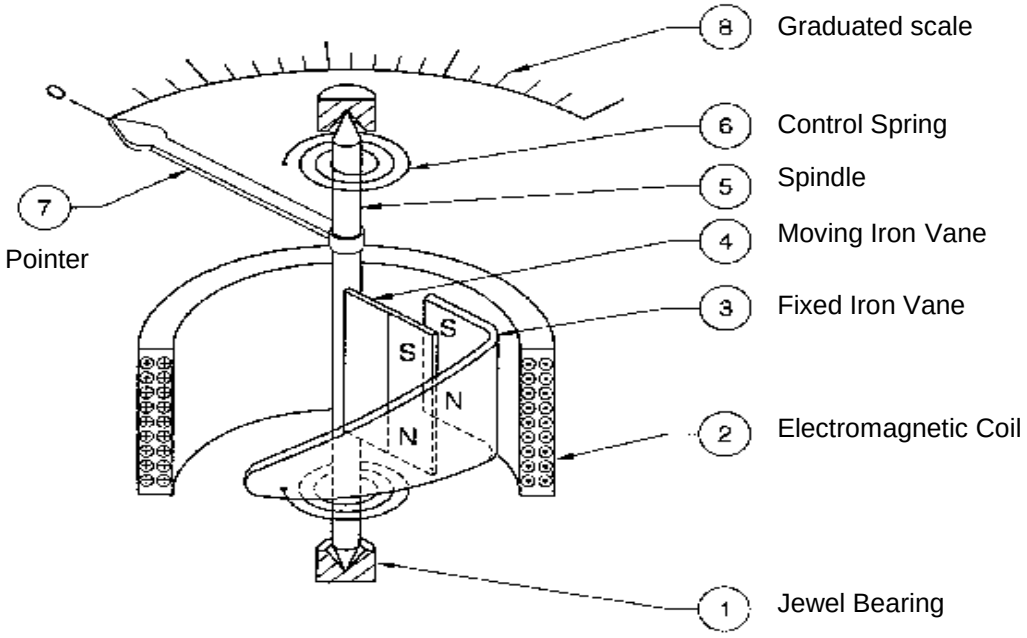

Figure 2

(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 type of instrument circuit 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 = 120
Width of the coil = 25mm
Length of the coil = 35mm
Flux density in the gap = 0.1Wb/m^2

Calculate the deflecting torque when carrying a current of 20mA and the deflection, if the control spring constant is 2 x 10^{-6}Nm/Degree.

(9 marks)

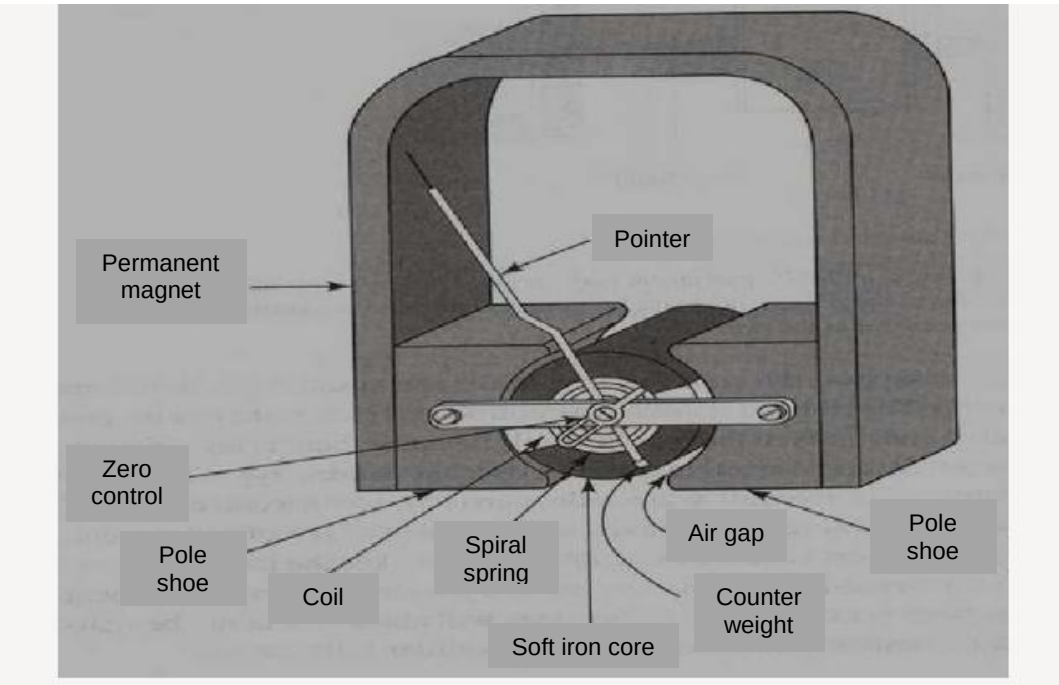

Figure 3

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 50Ω and full scale deflection for the current of 2mA. The required ranges are 0-5 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 60Ω and full scale deflection current of 5mA 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 0-50V and multiplier resistance of 10kΩ. 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.

(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)

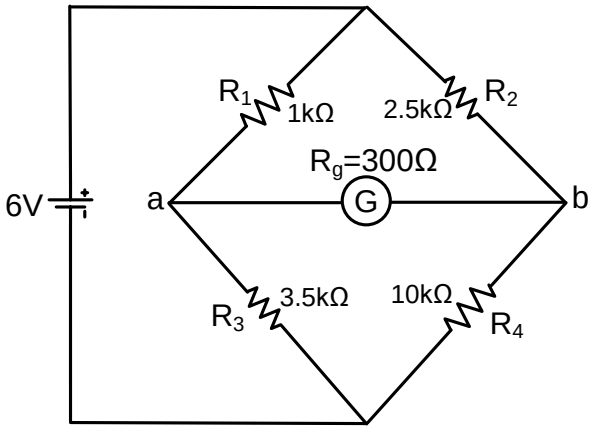

Figure 4

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*

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