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SET B

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2011 SESSION

SUBJECT CODE	:	FLD 10202
SUBJECT TITLE	:	INSTRUMENTATION
LEVEL	:	DIPLOMA
TIME / DURATION	:	12.30pm – 2.30pm (2 HOURS)
DATE	:	07 MAY 2011

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 7 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 student is given the following circuit schematic in electronics class. The student wires the circuit on his protoboard, hooks the circuit to the function generator, and attaches probes to measure the voltage at point C with scope channel 2. The function generator is also connected directly to scope channel 1 with a BNC "T" connector.

(a) The resistors has the following color codes. Write the corresponding values and tolerance of each resistor.

R_1 = Orange White Red Gold

R_2 = Brown Black Orange Gold

R_3 = Blue Red Orange Gold

R_4 = Brown Blue Orange Gold

(8 marks)

(b) The input signal from the function generator is given as $V_{(t)}$ = 400mV + 100mV sin (2π2000t +0°). Draw the input signal waveform when given horizontal sensitivity time/div is 100μsec/div and vertical sensitivity volt/div is 100mV/div.

(2 marks)

(c) Determine the peak to peak voltage of the output at point C measuring with channel 2 of the scope.

(2 marks)

(d) Now determine the average voltage of the output you are measuring with channel 2 of the scope.

(2 marks)

(e) Draw the output voltage at point C when given horizontal sensitivity time/div is 100μsec/div and vertical sensitivity volt/div is 100mV/div.

(2 marks)

(f) Determine the average current flowing in resistor R_1.

(2 marks)

(g) Explain the procedure to calibrate oscilloscope.

(2 marks)

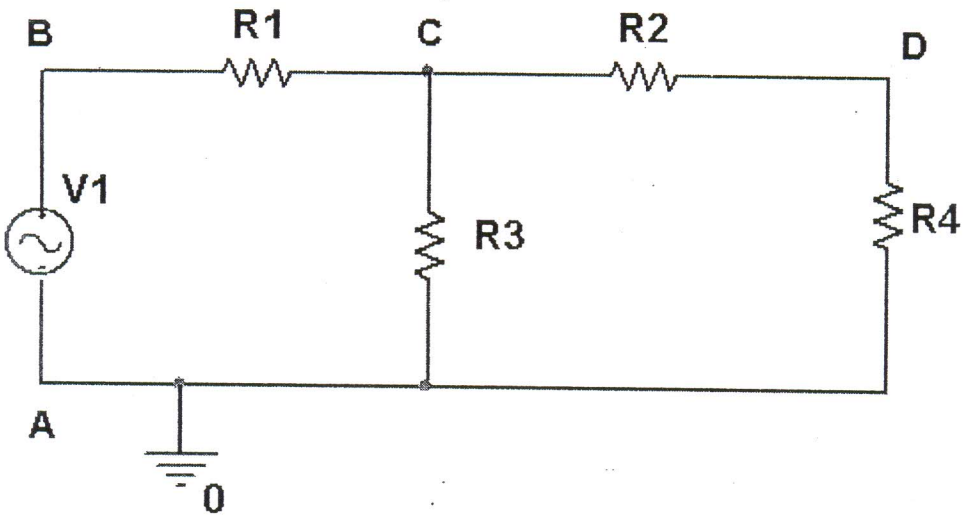

Figure 1

Question 2

(a) The r.m.s. current passing through a resistor of 120 ± 0.5 Ω is 2 ± 0.02 A. Calculate the limiting error in the value of power dissipation.

(3 marks)

(b) A particular bridge circuit gives the value of the unknown resistance as $R_x = \frac{R_2 R_3}{R_1}$.

The values of the known resistances are, R_1 = 120 ± 0.1 % Ω, R_2 = 2700 ± 0.5 % Ω and R_3 = 470 ± 0.5 % Ω. Determine the magnitude of the unknown resistance and the limiting error in percent and in ohms for the unknown resistance R_x.

(4 marks)

(c) The two resistances are specified as, R_1 = 36 ± 5 % Ω and R_2 = 75 ± 0.5 % Ω. Calculate the magnitude of limiting error in ohms and in percent if the two resistors are connected in parallel.

(4 marks)

(d) Define limiting error.

(2 marks)

(e) Define relative limiting error.

(2 marks)

(f) List five combination of quantities with limiting error.

(5 marks)

Question 3

The following questions refer to the instrument shown in **Figure 2**.

(a) Derive torque equation of Moving Iron instrument.

(5 marks)

(b) Explain briefly the basic operating principle of this instrument.

(4 marks)

(c) State the advantages, disadvantages and errors in Moving Iron instrument.

(3 marks)

(d) State the eight (8) fuctional parts shown below.

(8 marks)

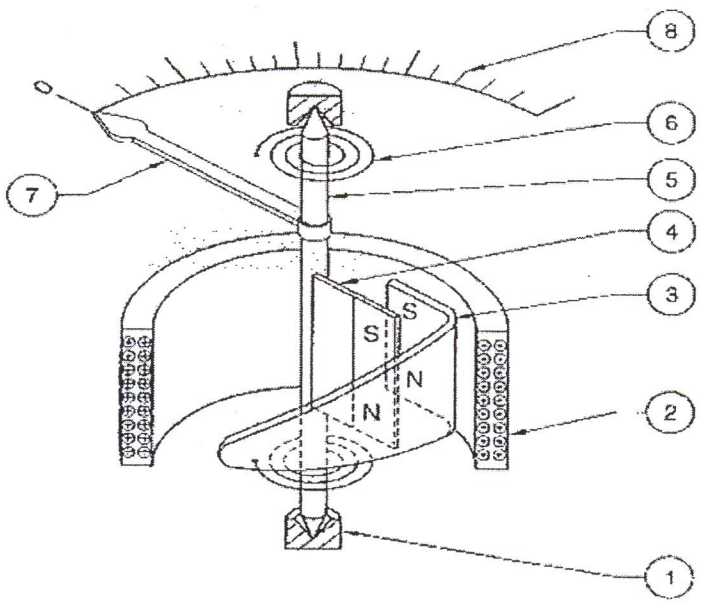

Figure 2

SECTION B (Total: 40 marks)

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

Question 4

(a) The Wheatstone bridge to be in balanced condition. Given R_1 = 10 kΩ, R_2 = 2 kΩ, R_3 = 5 kΩ and $R_4 = R_x$. Calculate the unknown resistance.

(4 marks)

(b) The Wheatstone bridge to be in unbalanced condition. Given R_1 = 7 kΩ, R_2 = 2 kΩ, R_3 = 4 kΩ, R_4 = 20kΩ, R_g = 300Ω and E= 8 V. Calculate the current through the galvanometer for the bridge.

(7 marks)

(c) State the application of Wheatstone bridge.

(3 marks)

(d) State the advantages of Wheatstone bridge.

(3 marks)

(e) State the limitation of Wheatstone bridge.

(3 marks)

Question 5

The various front panel controls of a simple CRO Cathode Ray Oscilloscope are divided into four groups: Basic Controls, Vertical Section, Horizontal Section and Trigger Section. Explain the following controls:

(a) Basic Control: Power on/off, Intensity, Focus, Trace Rotation and Calibration.

(5 marks)

(b) Vertical Section: AC-GND-DC, Vertical position, Volt/Div , Ch 1and Ch 2, Alt, Chop, Add and X-Y.

(8 marks)

(c) Trigger Section: Trigger Level, Slope, Source and Coupling.

(4 marks)

(d) Horizontal Section: Time/Div, Auto and Single sweep mode.

(3 marks)

Question 6

(a) Determine the reading of the voltmeter, if a voltmeter of input impedance 1MΩ is connected across points A and B shown in **Figure 3**.

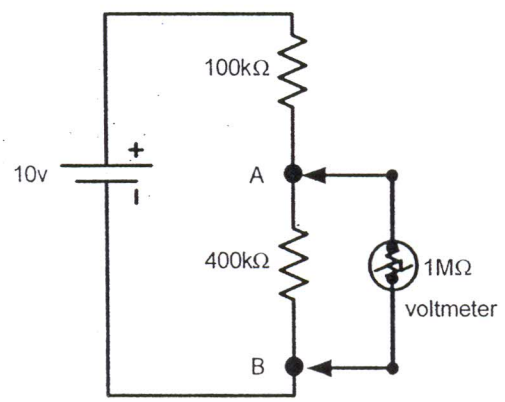

Figure 3

(5 marks)

(b) Determine the reading of the ammeter, if a student accidentally connects an ammeter of input impedance 100Ω across points A and B, (not the proper way to use an ammeter) shown in **Figure 4**.

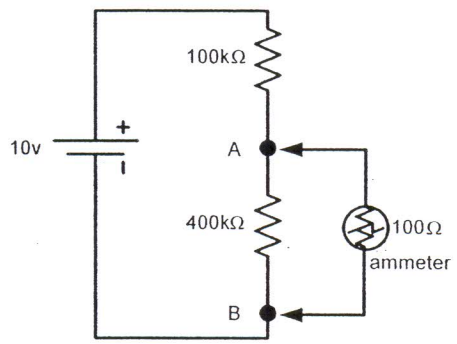

Figure 4

(5 marks)

(c) The **Figure 5** shows a simple series circuit of R_1 and R_2 connected to a 250 V d.c. source. If the voltage across R_2 is to be measured by the voltmeters having i) a sensitivity of 500 Ω/V ii) a sensitivity of 10000 Ω/V. Find which voltmeter will read more accurately. Both the meters are used on the 150 V range.

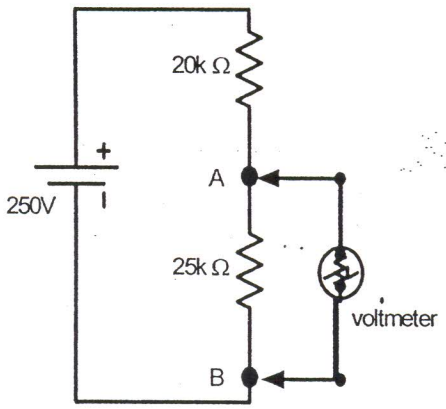

Figure 5

(10 marks)

END OF QUESTION PAPER

APPENDIX

FORMULA

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

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

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

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

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

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

7. $\tau_d = BxAxNxI$

8. $\tau_c = K\theta$

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

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

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

$$R_2 = \frac{I_{fsd} x R_m x R_h}{V - (I_{fsd} x R_h)}$$

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

13. $S = \frac{1}{I_m}$