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	:	**FLB11013**
SUBJECT TITLE	:	**INSTRUMENTATION**
LEVEL	:	**BACHELOR**
TIME / DURATION	:	**2.00 PM – 4.30 PM (2.5 HOURS)**
DATE	:	**5 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. **Answer 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 three (3) questions only.**
6. **Answer all questions in English.**

THERE ARE 5 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

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

Question 1

(a) State the categories of performance characteristics. List two examples for each category.

(6 marks)

(b) A resistance is measured by voltmeter ammeter method. Ammeter shows 4.45A on a 10A scale and voltmeter shows 100.5V on 300V range. Both ammeter and voltmeter are guaranteed to be accurate within ±0.1% of full scale reading.

(i) Find the indicated value of resistance

(ii) Calculate the limiting error of resistance within the accuracy value.

(8 marks)

Question 2

(a) Draw the basic diagram of a cathode ray oscilloscope (CRT) and label the function of each block.

(10 marks)

(b) List any three requirements of the laboratory type signal generator.

(3 marks)

Question 3

(a) The transducer has a physically compatible with its intended application. State three of the important requirements when selecting the suitable transducer.

(6 marks)

(b) Determine four advantages of the electrical transducer.

(4 marks)

(c) List three categories of transducer based on the principles of the transducer operation.

(3 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE (3) questions only

Please use the answer booklet provided.

Question 4

(a) Define the basic principles of the PMMC instrument?

(4 marks)

(b) List two the advantages and disadvantages of the PMMC instrument.

(4 marks)

(c) While selecting a meter for a particular measurement, the sensitivity rating is very important, because it will produce the accurate reading. Define the term of sensitivity of the voltmeter?

(2 marks)

(d) The **Figure 1** shows a simple series circuit of R_1 and R_2 connected to a 215V d.c source. If the voltage across R_2 is to be measured by two different voltmeters with the following parameters:

Voltmeter A: Sensitivity, S=8kΩ/V

Voltmeter B: Sensitivity, S=15kΩ/V

Both the meters are used on the 150V range.

(i) Calculate the error in the each voltmeter.

(ii) Determine which voltmeter will read more accurately and give the reasons.

(10 marks)

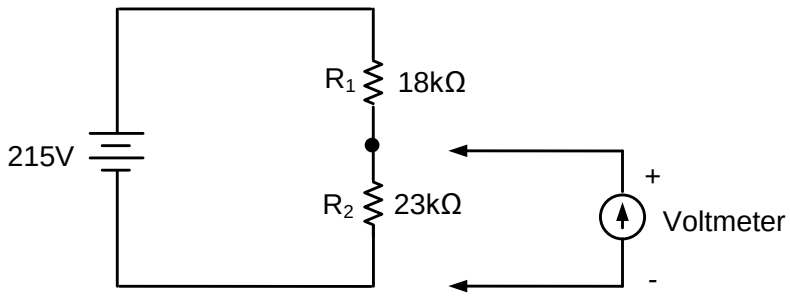

Figure 1

Question 5

(a) Give two examples of resistive position transducer and explain the basic principles of each transducer.

(8 marks)

(b) List three applications of the LVDTs.

(6 marks)

(c) Explain the concepts of capacitive transducer based on the following equation.

$$C = (KA) / (d)$$

Where,

K = the dielectric constant

A = the total area of the capacitor surfaces

d = distance between two capacities surfaces

C = the resultant capacitance

(6 marks)

Question 6

(a) The front panel control of simple oscilloscope can be divided into three categories: basic controls, vertical section and horizontal section. Explain the functions of the each category.

(6 marks)

(b) In an experiment, the voltage across a 15 kΩ resistor is applied to oscilloscope. The screen shows a sinusoidal signal of total vertical is 4 divisions and total horizontal is 4 divisions. 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. Determine the peak to peak voltage and hence calculate the rms value of the sinusoidal waveform $\mathbf{V_{rms}}$.

ii. Find its frequency.

iii. Determine the mathematical expression for the sinusoidal voltage as a function of time.

iv. Draw the waveform on the oscilloscope screen shown in **Figure 2.** (Please label your waveform)

(12 marks)

ANSWER 6(iv)

(PLEASE ATTACH TOGETHER WITH THE ANSWER BOOKLET)

ID Number: ---------- Group:----------

Figure 2

Question 7

(a) Define the term of signal conditioning and list the basic elements of a signal conditioning.

(4 marks)

(b) Design a differentiator to differentiate an input signal that varies in frequency from 20Hz to 800Hz. Given **C_1=0.1μF** and **R_1 = 10kΩ.** Draw the designed circuit.

(10 marks)

(c) If a sine wave of 2V peak at 800Hz is applied to the designed differentiator in part (b), draw its output voltage waveform.

(6 marks)

END OF QUESTION PAPER

APPENDIX

Standard Resistor Values (±5%)						
1.0	10	100	1.0K	10K	100K	1.0M
1.1	11	110	1.1K	11K	110K	1.1M
1.2	12	120	1.2K	12K	120K	1.2M
1.3	13	130	1.3K	13K	130K	1.3M
1.5	15	150	1.5K	15K	150K	1.5M
1.6	16	160	1.6K	16K	160K	1.6M
1.8	18	180	1.8K	18K	180K	1.8M
2.0	20	200	2.0K	20K	200K	2.0M
2.2	22	220	2.2K	22K	220K	2.2M
2.4	24	240	2.4K	24K	240K	2.4M
2.7	27	270	2.7K	27K	270K	2.7M
3.0	30	300	3.0K	30K	300K	3.0M
3.3	33	330	3.3K	33K	330K	3.3M
3.6	36	360	3.6K	36K	360K	3.6M
3.9	39	390	3.9K	39K	390K	3.9M
4.3	43	430	4.3K	43K	430K	4.3M
4.7	47	470	4.7K	47K	470K	4.7M
5.1	51	510	5.1K	51K	510K	5.1M
5.6	56	560	5.6K	56K	560K	5.6M
6.2	62	620	6.2K	62K	620K	6.2M
6.8	68	680	6.8K	68K	680K	6.8M
7.5	75	750	7.5K	75K	750K	7.5M
8.2	82	820	8.2K	82K	820K	8.2M
9.1	91	910	9.1K	91K	910K	9.1M

Standard Capacitor Values (±10%)						
10pF	100pF	1000pF	.010µF	.10µF	1.0µF	10µF
12pF	120pF	1200pF	.012µF	.12µF	1.2µF	
15pF	150pF	1500pF	.015µF	.15µF	1.5µF	
18pF	180pF	1800pF	.018µF	.18µF	1.8µF	
22pF	220pF	2200pF	.022µF	.22µF	2.2µF	22µF
27pF	270pF	2700pF	.027µF	.27µF	2.7µF	
33pF	330pF	3300pF	.033µF	.33µF	3.3µF	33µF
39pF	390pF	3900pF	.039µF	.39µF	3.9µF	
47pF	470pF	4700pF	.047µF	.47µF	4.7µF	47uF
56pF	560pF	5600pF	.056µF	.56µF	5.6µF	
68pF	680pF	6800pF	.068µF	.68µF	6.8µF	
82pF	820pF	8200pF	.082µF	.82µF	8.2µF	