JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

UNIVERSITY EXAMINATIONS FOR THE DEGREE IN SCIENCE IN RENEWABLE ENERGY TECHNOLOGY AND MANAGMENT

2ND YEAR 1ST SEMESTER 2018/2019 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: SPH 3231

COURSE TITLE: MEASUREMENTS AND INSTRUMENTATIONS

EXAM VENUE: **STREAM: BSc REN ENERGY TECH & MGT**

DATE: ../12/2018 **EXAM SESSION:**

DURATION: 2 HOURS

Instructions

1. **Answer question 1 (Compulsory) and ANY other two questions**
2. **Candidates are advised not to write on question paper**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

QUESTION ONE

a). i. Explain why every measurement must contain an error, giving examples.(6 marks)

ii. In a schematic logical diagram show how the errors above result in Total Error.(3 marks)

iii. What are the causes of each error and how can each of these errors be eliminated during measurement? Give at least two common methods of elimination.(4 marks)

b). Use the given table below to solve the following questions.

TEST	FREQUENCY *(HZ)*	INDICATED FREQUENCY *(HZ)*
1.	*415*	*417*
2.	*432*	*437*
3.	*424*	*428*
4.	*425*	*430*
5	*417*	*419*
6.	*423*	*420*
7.	*420*	*420*

i. Determine the systematic error of the instrument that is being tested; give any assumptions taken and clearly explain the meaning of your results. (**2 marks**)

ii. What action would you take once you have estimated the above error?**(1 mark)**

iii. Find the probable error in the distributed frequency (HZ) from the data of systematic error you generated from the table of measurement in Q2b (i).**(2 Marks)**

iv. Evaluate the total error in the measurement exercise process take above.**(1 marks)**

v. Calculate the class of the instrument in the above measurement if it has a scale with a range of 0 to 200 Hz**(4 Marks)**

c) Design a multi range D.C. mille- ammeter using a basic movement with an internal resistance Ω= 50mR and a full scale deflection current mA Im 1 = The ranges required are 0-10mA; 0-50mA; 0-100mA and 0-500mA **(7 Marks)**

QUESTION TWO

(a) (i) Differentiate the following terms: - measurement, instrument and instrumentation. **(3marks)**

(ii) State and briefly explain the five elements of measurement **(5marks)**

(b) Differentiate the following characteristics used to describe the performance of instrument systems, giving clear examples.

(i) Accuracy form Precision (ii) sensitivity form Resolution **(4 marks)**

(vi) Differentiate between static and dynamic characteristics, giving examples. **(2 marks)**

c). Every student in a class of six, was given a resistor of the same resistance value. But upon using a sensitive ohmmeterevery student came up with the following readings: -

100.002 Ω, 98.9890 Ω, 99.056 Ω, 100.092 Ω, 100.000 Ω and 99.999 Ω.

Find: -

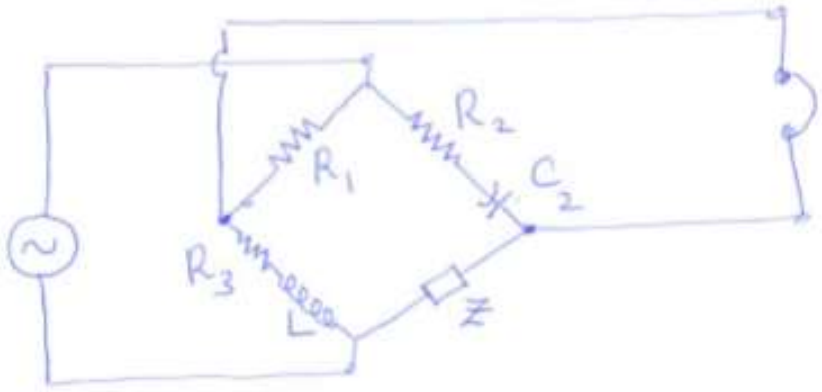
i. Arithmetic mean (2 marks)
ii. Standard deviation (2 marks)
iii. Variance (2 marks)

QUESTION THREE

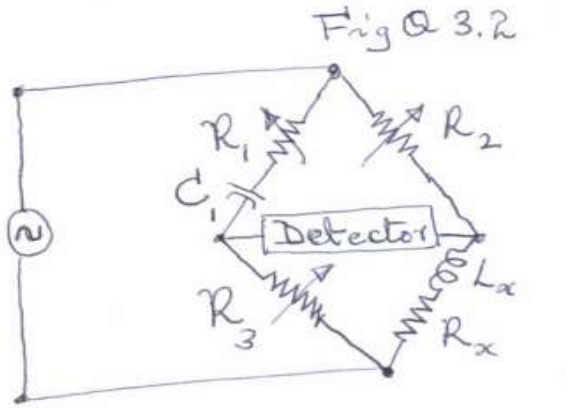
a) What are the advantages of Bridge Circuits? **(5 Marks)**

b) **A** balanced AC bridge circuit shown in Fig Q 3.1 bellow is used to calculate impedance, Z_4. The following values are given for R1= 225 Ω, R2 =150 Ω , and C2 = 0.53 μF. R3 =100 Ω, and is in series with L = 7.93 mH. The oscillator frequency is kHz. **(8 Marks)**

Fig. Q 3.1



c) The bridge circuit (Maxwell's Bridge) bellow in Fig Q 3.2 is used to measure inductive impedance.
The bridge constants at balance are: -
R_1= 235KΩ, C_1 = 1.20μF, R_2 = 2.5 KΩ, R_3= 50 kΩ



Find the series equivalent of the unknown impedance **(7 Marks)**

QUESTION FOUR

a). Briefly describe how each of the following devices is used to measure flow.

i. Orifice plate (2 marks)
ii. Venturi (2 Marks)
iii. Flow nozzle (2 Marks)
iv. Elbow tap (2 Marks)
v. Pitot tube (2 Marks)

b). For each of the following devices explain how flow measurements will be affected by

i. Changes in fluid temperature (3marks)
ii. Changes in fluid pressure (3Marks)
iii. Erosion of: -
    1. Orifice plate (1.5 Marks)
    2. Venturi (1.5 Marks)
    3. Flow nozzle (1.5 Marks)
    4. Elbow tap (1.5 Marks)

QUESTION FIVE

a). What is a transducer?**(2 Marks)**

b). Differentiate active from passive transducers, and give suitable examples **(4 Marks)**

5(a) Draw a cathode ray oscilloscope and labelled all the major parts, giving describing clearly the function of each of these parts. **(9 marks)**

(b)Draw a typical face panel of an oscilloscope (1 mark) then label, and explain the function of any four important features on the scope. **(5 marks)**