UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET

COURSE CODE	: BMT 2073
COURSE	: INSTRUMENTATION AND MEASUREMENT
SEMESTER/SESSION	: 2-2023/2024
DURATION	: 3 HOURS

Instructions:

1. This booklet contains 4 questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise up your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 6 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) List five (5) sources of error for dynamic characteristic.

(5 marks)

b) Explain the difference between absolute error and relative error.

(4 marks)

c) Refer to **Figure 1**, calculate the error percentage and accurate percentage if meter ampere shows the value of 4 mA.

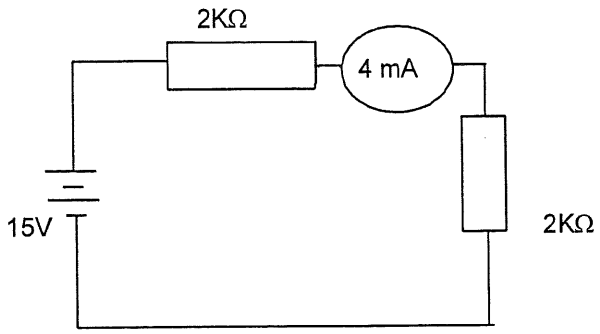

Figure 1

(6 marks)

d) Given expected voltage value across a resistor is 99 V. The measurement is 97 V. Calculate:

i) The relative accuracy (3 marks)

ii) The % of accuracy (2 marks)

QUESTION 2

a) Describe the principal of operation for D'Arsonal Meter Movement (5 marks)

b) **Figure 2** shows an Aryton shunt of an ammeter with a current range of 0 – 1 mA, 10 mA, 50 mA and 100 mA. A D' Arsonval movement with an internal resistance of 100 Ω and full scale current of 50 μA is used. Calculate the value of RA, RB, RC, and RD.

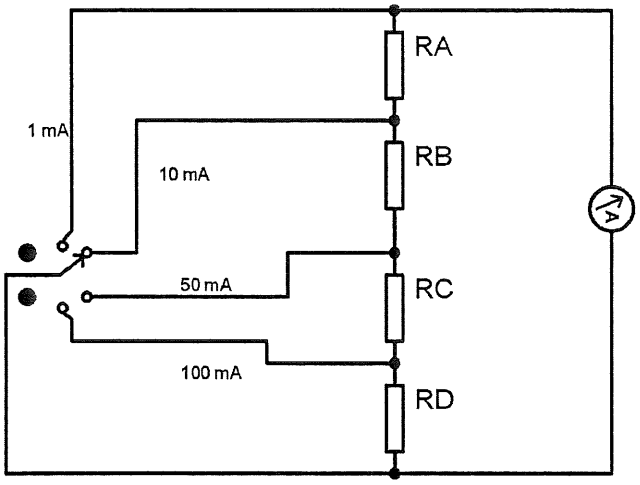

Figure 2

(16 marks)

c) A basic D'arsonval movement with full-scale deflection of 500Ω coil resistance and 50uA current full-scale deflection is used as a DC voltmeter. Determine :

i) The sensitivity value, S. (3 marks)

ii) The value of the multiplier resistance,R_s needed to measure a voltage range of 0-10V.

(4 marks)

d) Two different voltmeters are used to measure the voltage across R2 in the circuit in **Figure 3**. The meters are as follows:

Voltmeter 1 :5 V range, S = 20 kΩ/V.

Voltmeter 2 :10 V range, S = 20 kΩ/V.

Let Vs = 40V, R1 = 20 kΩ, R2 = 1 kΩ and R3 = 10 kΩ. Identify which voltmeter introduces least error due to loading.

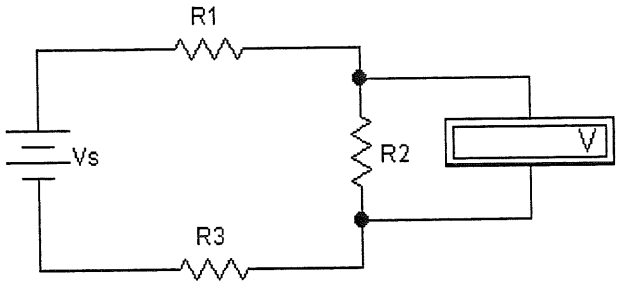

Figure 3

(12 marks)

QUESTION 3

a) Describe how 2-Bit Asynchronous Counter working. (4 marks)

b) Dual-slope A/D converter also known as counter-ramp or digital ramp ADC. It commonly used in measurement instruments such as digital Voltmeter. Describe how the Dual-slope A/D converter functions with the help of a related diagram.

(6 marks)

c) Describe the operating principle of a ramp type digital voltmeters (DVM) based on **Figure 4.**

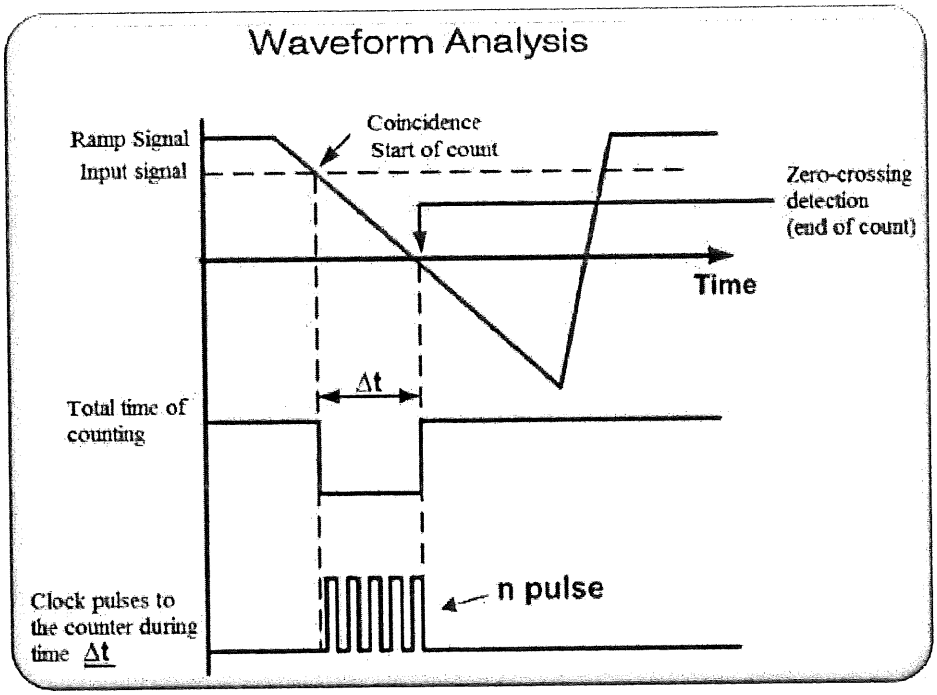

Figure 4

(6 marks)

d) 3½ digit is the number of digit positions used in a digital meter. Calculate the resolution of a 3½ digit display on:

i) 1 V

ii) 10 V

(4 marks)

QUESTION 4

a) Define the Cathode-Ray Oscilloscope (CRO)

(2 marks)

b) The cathode ray tube (CRT) is a vacuum tube containing an electron gun (a source of electrons) and a fluorescent screen, with internal or external means to accelerate and deflect the electron beam, used to create images in the form of light emitted from the fluorescent screen. Explain how cathode ray tube (CRT) functioning.

(8 marks)

c) The oscillographic amplifiers can be classified into two major categories. Describe for both oscillographic amplifiers.

(10 marks)

----------End of question----------