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UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: BMT 2073
COURSE TITLE	: INSTRUMENTATION & MEASUREMENT
SEMESTER/SESSION	: 2 - 2024/2025
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) In measurement, the measured value always different from the expected value. This difference is called as an error. Describe FOUR(4) major sources of error in measurement.

(8 marks)

b) An industrial grade ammeter (0 - 50mA) was compared with a precision grade ammeter and the following test data as shown in Table 1. Resolve whether the industrial grade ammeter is within the required percent error of full-scale range.

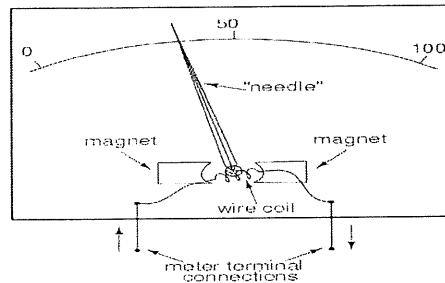(8 marks)

Table 1 : Ammeter reading data

Industrial (mA)	0	10.0	20.0	30.0	40.0	50.0
Precision (mA)	0	9.6	18.4	28.9	39.2	49.5

c) A 300-V voltmeter is specified to be accurate within ±2% at full scale. Compute the limiting error when the instrument is used to measure a 150-V source?
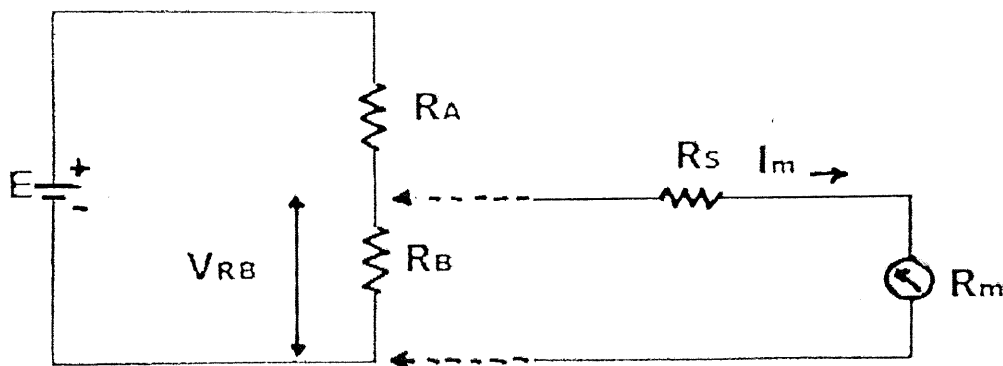
(4 marks)

QUESTION 2

a) Based on Figure 1, describe the movement of the meter using D'Arsonval Principal. (7 marks)

Figure 1

b) Describe with a diagram how voltage in μV range is measured. (12 marks)

c) A volt meter (0-10V) that has an internal resistance of 70Ω is used to measure the voltage across resistor R_B in Figure 2. Calculate the percentage of error of the reading due to voltmeter insertion. Let E = 4V, $R_A = R_B$ = 1kΩ , Sensitivity = 1kΩ/V. (12 marks)

Figure 2

d) An ammeter (as in Figure 3) has a Permanent Magnet Moving Coil (PMMC) instrument with a coil resistance of R_m= 80 Ω and full-scale deflection (FSD) current of 0.5 mA. Shunt resistance R_s = 1 Ω. Calculate the total current passing through the ammeter at :

  i. 0.25 FSD   (3 marks)

  ii. 0.5 FSD   (3 marks)
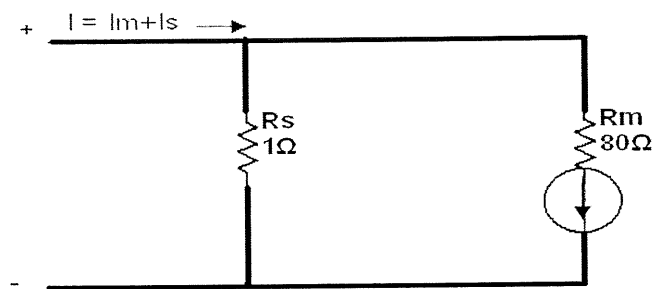
  iii. 0.8 FSD   (3 marks)

Figure 3

QUESTION 3

a) Digital Voltmeters (DVMs) are measuring instruments that convert analog voltage signals into a digital/numeric readout. DVM will display AC and DC voltages as discrete number, rather than as a pointer on a continuous scale as in an analog voltmeter.

    i.   Label the block diagram of a Staircase Ramp Type in Figure 4 below.
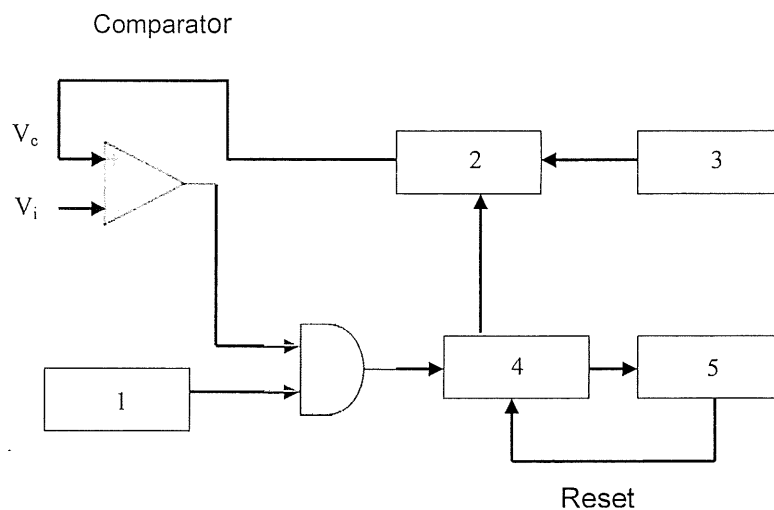
(5 marks)

Figure 4

    ii.   Describe the principle of digital voltmeter.   (3 marks)

    iii.   Distinguish the advantages of a numerical readout.   (2 marks)

b) Describe with a diagram the operational of a ramp type digital voltmeters (DVM)

(10 marks)

QUESTION 4

a) Describe the basic diagram of a cathode ray tube (CRT).   (5 marks)

b) Distinguish FIVE (5) important features of CRT.   (5 marks)

c) The waveform shown in Figure 5 is observed on the screen of an oscilloscope. If the vertical attenuation is set to 5 *V/div* and 20 *ms/div*, calculate:

    i.   Peak to peak amplitude, peak amplitude and V_{rms} of the signal in Volt.

                                                  (6 marks)

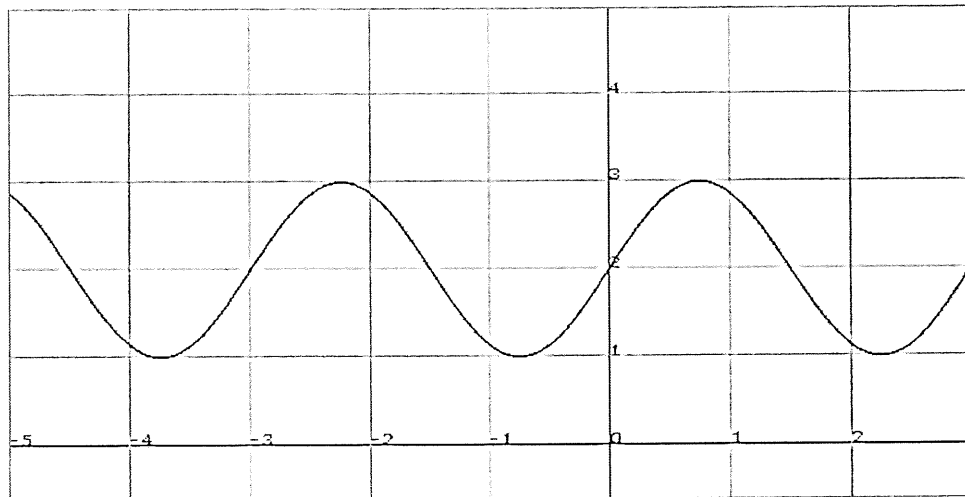   ii.   Frequency of the signal in *Hz*.   (4 marks)

Figure 5

---End of question---