Benha University
Faculty of engineering (Shoubra)

Instrumentations and Measurements
Midterm Exam (Time: **60** min.)

Name: Model Answer **ID**:

Question 1: Choose the right answer:

1. The difference between the expected value and measured value of a variable is known as:
   (a) absolute error (b) instrumental error
   (c) gross error (d) random error

2. To convert a 1 mA PMMC having a resistance of 100 Ω into a 30V voltmeter, the required series resistance is:
   (a) 100000 Ω (b) 1000 Ω
   (c) 29900 Ω (d) 0.101 Ω

3. The maximum error of a reading in DVM depends on:
   (a) Accuracy of the DVM. (b) The selected scale or range.
   (c) The value of the reading itself. **(d) all of the above.**

4. In Dual-slope DVM, the integrator is charging:
   (a) With a rate that is depending on the input voltage. (b) With a rate depending the time base frequency.
   (c) With a constant rate. (d) With a rate proportional to the counter value.

5. The FET transistor is used in the analog voltmeter to:
   (a) Increase the input resistance. (b) Attenuate the input voltage.
   (c) Decrease the input resistance. (d) None of the above.

Question 2: (a) Give two examples for:
(1) Gross errors and (2) Systematic errors in electrical instruments.
(b) State why we need a make-before-break switch in multi-range PMMC ammeters.

(a): (1) Gross errors: - Transpose of the readings while recording. (24.9 mV instead of 29.4 mV)
- A wrong scale may be chosen in analog instruments.
(2) Systematic errors: - incorrect device calibration.
- Errors introduced by the parallax error.
(b) We need a make-before-break switch in multi-range PMMC ammeters to make sure that there always be a shunt resistance is connected in parallel with the PMMC circuit. Otherwise, if an ordinary switch is used the contact may be floating and the whole current to be measured flow in the PMMC and destroy it.

Question 3: A PMMC instrument with an 800 Ω coil resistance and an FSD of 100 μA is to be used as a dc voltmeter. Calculate the individual multiplier resistance to give an FSD of (a) 100V, (b) 50V. Also, determine the voltmeter sensitivity in each case.

Rs = V/Im – Rm

(a)For 100V:

Rs = (100V/100uA) – Rm = 1Mohm – 800ohm = 999200 Kohm

Sensitivity = (Rm + Rs)/V = 1Mohm/100V = 10Kohm/V

(b) For 50:

Rs = (50V/100uA) – Rm = 0.5Mohm – 800ohm = 499200 Kohm

Sensitivity = (Rm + Rs)/V = 0.5Mohm/50V = 10Kohm/V

Best wishes,
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