

Code: AE60 Subject: INSTRUMENTATION & MEASUREMENTS

AMIETE – ET (NEW SCHEME)

Time: 3 Hours

DECEMBER 2011

Max. Marks: 100

NOTE: There are 9 Questions in all.

- Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.
- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2×10)

- a. In measurement systems, which of the following static characteristics are desirable?
- (A) Accuracy (B) Sensitivity
(C) Reproducibility (D) All of the above
- b. The sensitivity of a 200 μA meter movement which is to be used as a dc voltmeter is
- (A) 5 k Ω/V (B) 50 k Ω/V
(C) 0.5 k Ω/V (D) 5 Ω/V
- c. A 1 mA meter movement with an internal resistance of 100 Ω is to be converted into a 0-100 mA. The value of shunt resistance required is
- (A) 101 Ω (B) 1.01 Ω
(C) 0.101 Ω (D) 101 k Ω
- d. LVDT stands for
- (A) Linear Voltage Differential Transducer
(B) Linear Voltage Differential Transformer
(C) Linear Variable Differential Transducer
(D) Linear Variable Differential Transformer
- e. The maximum value of voltage is 8 V and the minimum value of voltage is 2 V in a standing wave pattern, the SWR is
- (A) 166 (B) 1.66
(C) 1.6 (D) 0.166

Code: AE60 Subject: INSTRUMENTATION & MEASUREMENTS

- f. Phosphor coating for cathode ray tubes is provided on
- (A) inside the surface (B) outside the surface
(C) both (A) & (B) (D) within the glass
- g. Kelvin bridge is used to measure
- (A) Capacitance (B) Inductance
(C) Resistance (D) None of these
- h. A 4 ½ digital voltmeter is used for voltage measurements. Its resolution is
- (A) 0.0001 (B) 0.001
(C) 0.01 (D) 0.1
- i. Thermocouples are
- (A) active transducers
(B) passive transducers
(C) both active and passive transducers
(D) output transducers
- j. A true rms reading voltmeter uses two thermocouples in order
- (A) to increase sensitivity
(B) that second thermocouple cancels out the non-linear effects of the first thermocouple
(C) to prevent drift in the dc amplifier
(D) all of the above

**Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.**

- Q.2** a. What are different types of errors in measurements? Explain all the errors by giving suitable examples. Discuss the means adopted to reduce these errors. (8)
- b. Three resistors connected in parallel have following values:
R1 = 250Ω has a +0.025 fractional error
R2 = 500Ω has a -0.036 fractional error
R3 = 375Ω has a +0.014 fractional error
Determine (i) total resistance neglecting errors
(ii) total resistance considering the error of each resistor
(iii) fractional error of the total resistance based upon rated values (8)
- Q.3** a. Describe the working of a low voltage Schering bridge. Derive the equations for capacitance and dissipation factor. Draw the phasor diagram of the bridge under conditions of balance. (8)

Code: AE60 Subject: INSTRUMENTATION & MEASUREMENTS

- b. A Wheatstone bridge has ratio arms of $1000\ \Omega$ and $100\ \Omega$ and is being used to measure an unknown resistance of $25\ \Omega$. Two galvanometers are available. Galvanometer 'A' has a resistance of $50\ \Omega$ and a sensitivity of $200\ \text{mm}/\mu\text{A}$ and galvanometer 'B' has a resistance of $600\ \Omega$ and a sensitivity of $500\ \text{mm}/\mu\text{A}$. Which of two galvanometer is more sensitive to a small unbalance on the above bridge, and what is the ratio of sensitivities? The galvanometer is connected from the junction of the ratio arms to the opposite corners. (8)

- Q.4** a. With the help of a neat diagram, explain true rms voltmeter. (8)
- b. Convert a basic D'Arsonval movement with an internal resistance of $50\ \Omega$ and a full scale deflection current of $2\ \text{mA}$ into a multirange dc voltmeter with voltage ranges of $0 - 10\ \text{V}$, $0 - 50\ \text{V}$, $0 - 100\ \text{V}$ and $0 - 250\ \text{V}$. (refer Fig.1) (8)

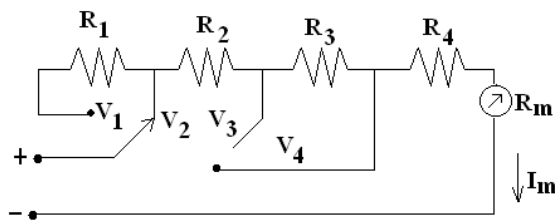


Fig. 1

- Q.5** a. Explain with the help of a neat diagram the working of a Digital Frequency Meter. (8)
- b. The self capacitance of a coil is measured by a Q-meter. The circuit is set into resonance at $2\ \text{MHz}$ and the tuning capacitor of the value of $460\ \text{pF}$. The frequency is now adjusted to $4\ \text{MHz}$ and resonance conditions are obtained. Calculate the value of self-capacitance of the coil, if the turning capacitor is at $100\ \text{pF}$. (8)
- Q.6** a. Draw the block diagram of AF sine and square wave generator. Also explain the function of each block. List the various controls on the front panel of the generator. (8)
- b. Explain the basic block diagram of sampling oscilloscope and draw the waveforms at each block of a sampling oscilloscope. (8)
- Q.7** a. What is a bolometer? Give the procedure of measuring power using a bolometer in a bridge circuit. (8)
- b. Explain with the block diagram, the working of a harmonic distortion analyzer. (8)
- Q.8** a. Discuss digital data recording. Also, State its advantages and disadvantages. (8)
- b. Explain the working of X-Y recorder. Give its applications. (8)

Code: AE60 Subject: INSTRUMENTATION & MEASUREMENTS

Q.9 a. What is a data acquisition system? Explain with the help of a block diagram of general data acquisition system. (8)

b. An ac LVDT has the following data:

Input=6.3 V, output =-5.2V, range ± 0.5 in. Determine:

(i) The output voltage Vs core position for a core movement going from +0.45 in. to -0.30 in.

(ii) The output voltage when the core is -0.25 in from the centre. (8)