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 kΩ

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

f. Phospher 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)**

b. A Wheatstone bridge has ratio arms of 1000 Ω and 100 Ω and is being used to measure an unknown resistance of 25 Ω. Two galvanometers are available. Galvanometer 'A' has a resistance of 50 Ω and a sensitivity of 200 mm/μA and galvanometer 'B' has a resistance of 600 Ω and a sensitivity of 500 mm/μA. 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 Ω and a full scale deflection current of 2mA into a multirange dc voltmeter with voltage ranges of 0 – 10V, 0 – 50V, 0 – 100V and 0 – 250V. (refer Fig.1)   **(8)**
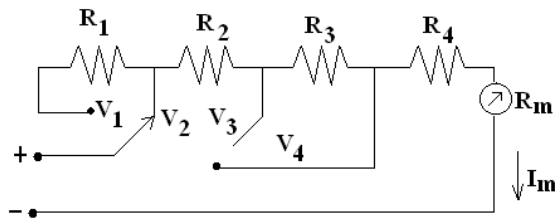
Fig. 1

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 MHz and the tuning capacitor of the value of 460 pF. The frequency is now adjusted to 4 MHz and resonance conditions are obtained. Calculate the value of self-capacitance of the coil, if the turning capacitor is at 100 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)**

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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 ±0.5in. 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)**