Code: AE111   Subject: INSTRUMENTATION AND MEASUREMENTS

AMIETE – ET *{NEW SCHEME}*

Time: 3 Hours   **DECEMBER 2014**   **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.
- **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. A measure of the repeatability of a measurement of some quantity is

   (A) Accuracy   **(B)** Error
   (C) Reproducibilty   **(D)** Precision

b. An integrator contains 100kΩ and 1µF capacitor. If the voltage applied to the integrator input is 1V. Output voltage of the integrator after 1s is

   (A) 10V   **(B)** 1V
   (C) 5 V   **(D)** 15 V

c. A digital voltmeter has a read-out range from 0-9999 counts. The resolution of instrument, when the full scale reading is 9.999V is

   (A) 11 mV   **(B)** 11 V
   (C) 1mV   **(D)** 1V

d. Device similar to an RTD, but has a negative temperature coefficient is

   (A) Strain gauge   **(B)** Thermistor
   (C) Thermocouple   **(D)** Negative-type RTD

e. The value of the multiplier resistance on the 50V dc voltmeter that uses a 500µA meter movement with an internal resistance of 1kΩ is

   (A) 2kΩ   **(B)** 20kΩ
   (C) 99Ω   **(D)** 99kΩ

f. Capacitance can be measured by

(**A**) Maxwell's bridge   (**B**) Schering's bridge
(**C**) Kelvin's bridge   (**D**) Wien's bridge

g. An aquadag is used in a CRO to collect

(**A**) primary electrons
(**B**) secondary emission electrons
(**C**) both primary and secondary emission electrons
(**D**) none of these

h. X-Y recorders

(**A**) record one quantity with respect to another quantity
(**B**) record one quantity on X axis with respect to time on Y- axis
(**C**) record one quantity on Y- axis with respect to time on X – axis
(**D**) none of the above

i. The inductance of the coil using Q- meter can be calculated by the expression

(**A**) $\dfrac{1}{2\pi fC}$ henry

(**B**) $\dfrac{1}{(2\pi f)^2 C}$ henry

(**C**) $2\pi fC$ henry

(**D**) $(2\pi f)^2 C$ henry

j. A bolometer is used for measurement of _____.

(**A**) Transmission loss   (**B**) High voltages
(**C**) Micro-wave power   (**D**) VSWR

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

Q.2 a. Differentiate between the direct and indirect method of measurement.   **(8)**

b. Define limiting errors. A 0-10A ammeter has an accuracy of 1.5% of full scale reading. The current indicated by the ammeter is 2.5 A. Calculate the limiting values of current and percentage limiting error.   **(8)**

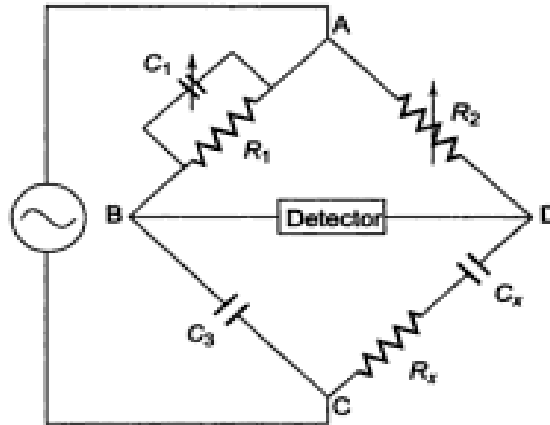**Q.3**   a.   An AC bridge shown in Fig 1, has the following parameters: **(8)**

Fig.1

Arm AB- capacitor of 0.5µF in parallel with 1kΩ resistance
Arm AD- resistance of 2kΩ
Arm BC- capacitor of 0.5µF
Arm CD- unknown capacitor C_x and R_x in series
Frequency-1kHz
Determine the unknown capacitance and dissipation factor.

b.   Find the equivalent series resistance (Rx) and inductance (Lx) at balance for the given bridge as show in Fig. 2   **(8)**
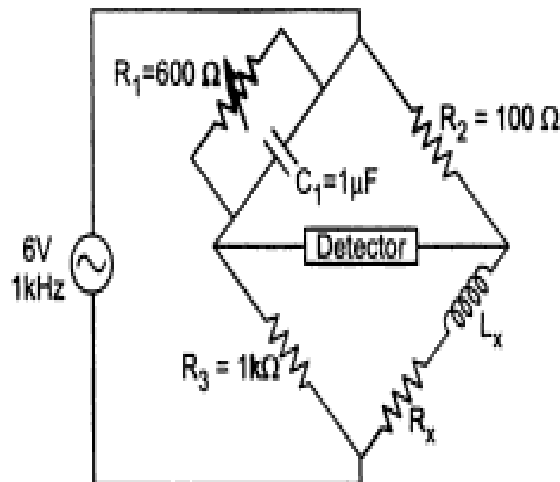

Fig.2

Q.4   a.   Calculate the multiplier resistor required for a 100Vrms range on the voltmeter shown in given Fig 3.   **(8)**
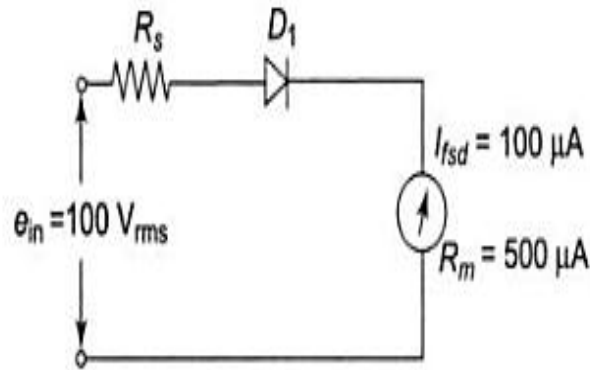

Fig.3

b.   Why a thermocouple is used in RF measurement of current?   **(8)**

Q.5   a.   Explain with the help of a neat block diagram, the working of a digital frequency meter.   **(8)**

b.   Explain with the help of a neat circuit diagram, the working of a dual slope DVM.   **(8)**

Q.6   a.   Draw the block diagram of a function generator and explain the method of producing sine waves.   **(8)**

b.   Draw the basic block diagram of an oscilloscope and explain the function of each block.   **(8)**

Q.7   a.   Explain an arrangement for the measurement of a standing wave ratio.   **(8)**

b.   Explain with the help of block diagram, the working of a harmonic distortion analyzer.   **(8)**

Q.8   a.   Compare X-Y recorders with strip chart recorders.   **(8)**

b.   Explain the working of a circular chart recorder.   **(8)**

Q.9   a.   Draw and describe the following for thermistors: **(8)**
    (i)   Resistance-temperature characteristics
    (ii) Voltage-current characteristics
    (iii) Current time characteristics

b.   Explain D/A and A/D converters w.r.t. signal conditioning of the inputs.   **(8)**