

AMIETE – ET (OLD SCHEME)

Code: AE12
Time: 3 Hours

Subject: Instrumentation and Measurement
Max. Marks: 100

DECEMBER 2010

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 half an hour 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. _____ time of a sample and hold circuit is the time required for the switch to change state and the uncertainty in time that this change of state occurs.

- (A) holding time (B) acquisition time
(C) aperture time (D) resolution time

b. A Wien bridge may be difficult to balance unless _____.

- (A) C_1 and C_3 are variable capacitors
(B) R_1 and R_2 are fixed resistors
(C) The wave form of the applied voltage is a pure sinusoid
(D) When the magnitude of R_4 is double that of R_2

c. The dynamic error of a measurand which is a function of time is defined as _____.

- (A) Errors of the instruments and measurands which are used for measurements
(B) The algebraic difference between the indicated/ recorded value of a measurand and its true value at any instant
(C) Errors that depend largely on the care and vigilance observed by the experimenter.
(D) Errors due to lack of knowledge/ judgement and care on the part of the experimenter.

d. In the counter A/D convertor _____.

- (A) Both the analog input and the output of the DAC are fed into a comparator whose output in turn is fed to the gating and control block.
(B) The DAC output fed into a flip flop register which in turn is fed into the gating and control block
(C) The output of the flip flop register which is fed into a D/A convertor becomes the required digital output
(D) The digital output feedback into the comparator whose output goes into the gating and control block

- e. For the measurement sensitivity of a receiver by the quieting method, the voltage required to produce 10 dB of quieting with a zero signal output noise as 6.31 RMS. Then the Voltage that should exist when the receiver is quieted – 10 dB is _____.
- (A) 1.85 V (B) 1.90 V
(C) 1.80 V (D) 11.75 V
- f. Considering a general purpose oscilloscope the delay line between the vertical amplifier and vertical deflecting plates is necessary because _____.
- (A) Both the vertical and horizontal amplifier outputs may get distorted
(B) The horizontal waveform may get distorted before it reaches the horizontal deflecting plates
(C) Part of the leading edge of the signal waveform will be lost and the sweep would not begin until several nano seconds
(D) Synchronous action may not materialize because of reasons other those mentioned in (a) to (c) above.
- g. A power factor meter is based on the principle of _____ .
- (A) Electrostatic instrument (B) Electrodynamic instrument
(C) Electro thermo type instrument (D) Rectifier type instrument.
- h. The size of an air-cored transducer as compared to an iron-cored counter part is _____ .
- (A) larger (B) smaller
(C) same (D) none of these
- i. In CRT the focusing anode is located _____ .
- (A) between the pre-accelerating and accelerating anodes
(B) after an accelerating anodes
(C) before the pre-accelerating anode
(D) none of above
- j. A digital voltmeter measures _____ .
- (A) peak value (B) peak-to-peak value
(C) rms value (D) average value

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

- Q.2** a. Distinguish between the operating principles of digital and analog voltmeters with a suitable diagram explain the operation of a digital voltmeter. (8)

b. Define (i) accuracy of a electrical meter and (ii) dynamic error. Suggest an experimental set up for measurement of precision of a measuring instrument (8)

Q.3 a. Show the locations and explain the functions of the following parts of a CRO:
 (i) Delay line (ii) Horizontal amplifier (iii) Trigger circuit (8)

b. Discuss the role played by the probes used with an oscilloscope. (8)

Q.4 a. Draw the circuit of a Schering bridge? Obtain the balance conditions for the bridge. (8)

b. The ac bridge of Fig.1 given below is in balance with the following constants; arm AB, $R=450\Omega$, arm BC, $R=300\Omega$ in series with $C=0.265\mu\text{F}$, arm CD, unknown; arm DA, $R=200\Omega$ in series with $L=15.9\text{mH}$. The oscillator frequency is 1 kHz. Find the constants of arm CD. (8)

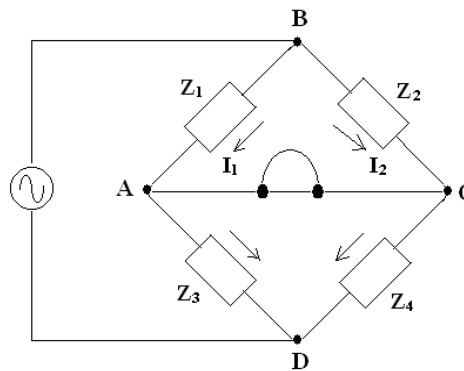


Fig. 1

Q.5 a. Describe a frequency selective wave analyzer. Explain how the spectrum analyzer differs from the same. (8)

b. (i) Discuss the two types of frequency instability occurring in a spectrum analyzer; (8)
 (ii) Explain the necessity of phase locking.

Q.6 a. Define sensitivity and selectivity of a radio receiver and explain their significance. (8)

b. Describe a method of measuring receiver sensitivity. (8)

Q.7 a. Considering two parallel wires separated by a distance 'r' each carrying a 1A current and each with a length of 1m, derive the units of flux density. (8)

b. Explain the reason for 'dead-zone' occurring in the characteristics of systems. Name some other terms that imply the presence of dead-zone and draw typical characteristics to indicate the same. (8)

Q.8 a. Draw and describe a counter type ADC that incorporates a DAC. (8)

b. Explain the use of a multiplexer in a typical digital system. (8)

- Q.9**
- a. State with reasons whether the following are self generating type transducers: thermistors, strain transducers, metals that obey Seebeck effect. (8)
 - b. Distinguish between time constant, measurement lag and dead time. (8)