53 (IE 504) ELIN

2019

ELECTRONIC INSTRUMENTATION

Paper : IE 504

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* Draw the circuit diagrams for the following : 12

   (i) A.C voltage measurement using OPAMP

   (ii) D.C voltage measurement using FET and BJT

   (iii) Measurement of current using OPAMP

   (iv) Series Ohm meter.

   Explain each circuits in brief.

Contd.

(b) Sketch the block diagram of vector impedance meter and describe the operation of the meter. Also, write some of its important applications. 8

2. (a) Describe how capacitance can be measured in an electronic instrument. What is its advantage? 5

(b) What is a Q meter? How can it be used for low impedance measurements? Write relevant mathematical expressions. 7

(c) Explain the working of a function generator using a suitable block diagram. 8

3. (a) Describe the working of following subsystems in an Oscilloscope using appropriate diagrams and waveforms: 12

(i) Vertical deflection subsystem

(ii) Horizontal deflection subsystem.

(b) If the vertical sensitivity of a scope is set to 20 *mV/div*, how much and in what direction will the following voltages applied to the vertical inputs of the scope deflect the spot? 2

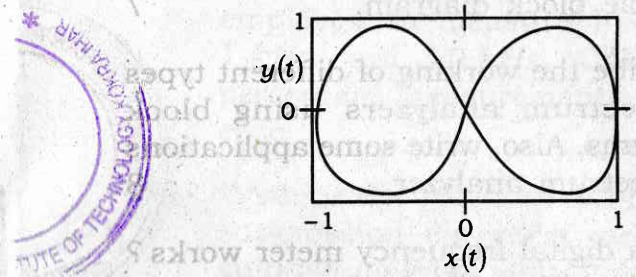
(i) $-40\ mV$

(ii) $75\ mV$

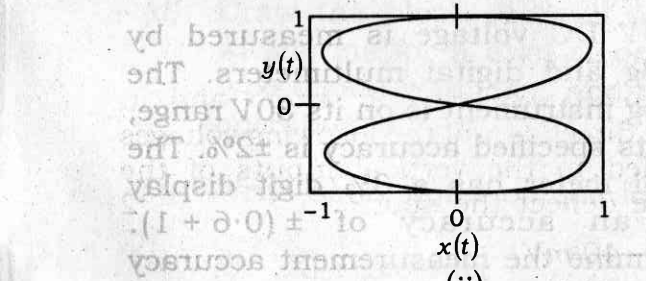
(c) The horizontal distance between two points of the signal waveform in an Oscilloscope is 5 division. The horizontal sweep is set to 0·5 *m/s* div. What is the time duration between the points?

If the two points are beginning and end of a cycle of a periodic function, what is the frequency of the waveform? 2

(d) For the following Lissajous figures, determine the unknown frequency assuming that the reference frequency is 1 *kHz* and is applied to the *y* input? 4



(i)



(ii)

4. *(a)* A $1V$ signal with a source resistance of $R_S = 100\Omega$ is connected to an oscilloscope which has an input impedance of $R_i = 1M\Omega$ in parallel with $C_1 = 20pF$. The coaxial cable has a capacitance of $C_{cc} = 200pF$. Calculate the oscilloscope terminal voltage (V_i) when the signal frequency is 50 *Hz*. Also determine the frequency at which V_i is $3dB$ below V_s. 5

(b) Explain the working of frequency synthesized signal generator with a suitable block diagram. 7

(c) Describe the working of different types of spectrum analyzers using block diagrams. Also, write some applications of spectrum analyzer. 8

5. *(a)* How a digital frequency meter works ? Explain with a diagram. 6

(b) A $20V$ DC voltage is measured by analog and digital multimeters. The analog instrument is on its $30V$ range, and its specified accuracy is ±2%. The digital meter has a 3½ digit display and an accuracy of ± (0·6 + 1). Determine the measurement accuracy in each case. 4

(c) Draw the circuit for square wave generator using transistors. 3

(d) Sketch the basic system block diagram of Digital Storage Oscilloscope (DSO) and explain its operation. 7

6. *(a)* Calculate the maximum time t_1 required by a digital voltmeter to count 1800 number of pulses if the clock generator frequency is 1·5 *MHz*. 2

(b) A digital frequency meter with an accuracy of $\pm 1LSD \pm \left(1 \times 10^{-6}\right)$ is employed to measure frequencies of 1 *kHz* and 10 *kHz*. Calculate the percentage measurement error in each case. 4

(c) Describe the operation of a fundamental suppression distortion meter using a suitable diagram. 7

(d) Draw the block diagram and system waveforms for a dual slope integrator type digital voltmeter, and describe its operation. 7

7. *(a)* Write short notes on the following : 6×2=12

(i) X–Y recorder

(ii) IEEE 488 Bus.

(b) What are the different types of interferences in a measurement system ? Describe briefly. Also discuss the different methods used for reducing the effect of interferences in a measurement system. 8