

**ELECTRONIC INSTRUMENTATION
(AEIE 3224)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

Candidates are required to give answer in their own words as far as practicable.

**Group – A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) The purpose of the synchronising control in a CRO is to
 - (a) adjust the amplitude of display
 - (b) control the intensity of the spot
 - (c) focus the spot on the screen
 - (d) lock the display of signal.
 - (ii) The time base signal in a CRO is
 - (a) a sinusoidal signal
 - (b) a sawtooth signal
 - (c) a square wave signal
 - (d) a triangular wave signal.
 - (iii) Sampling oscilloscopes are specially designed to measure
 - (a) very high frequency
 - (b) very low frequency
 - (c) microwave frequency
 - (d) none of these.
 - (iv) A double beam oscilloscope has
 - (a) two screens
 - (b) two electron guns
 - (c) two different phosphor coatings
 - (d) one waveform divided into two parts.
 - (v) At which state the phase-locked loop tracks any change in input frequency?
 - (a) Free running state
 - (b) Capture state
 - (c) Phase locked state
 - (d) All of the mentioned.
 - (vi) Which of the following application uses voltage to current converter?
 - (a) Low voltage dc and ac voltmeter
 - (b) Diode match finding
 - (c) Light emitting diode
 - (d) All of the mentioned.
 - (vii) Harmonic distortion is due to
 - (a) change in the behaviour of circuit elements due to change in temperature
 - (b) change in the behaviour of circuit elements due to change in environment
 - (c) linear behaviour of circuit elements
 - (d) nonlinear behaviour of circuit elements.

- (viii) A spectrum analyser is used across the frequency spectrum of a given signal to study the
(a) current distribution (b) voltage distribution
(c) energy distribution (d) power distribution.
- (ix) With a laser printer, what creates the image on the photosensitive drum?
(a) Primary corona (b) Transfer corona
(c) Toner (d) Laser imaging unit.
- (x) What does LabVIEW stand for?
(a) Laboratory Viewpoint
(b) Learning Based Viewpoint
(c) Laboratory Virtual Instrumentation Engineering Workbench
(d) Learning Virtual Instrumentation Engineering Workbench.

Group - B

2. (a) A 500 Hz triangular wave with a peak amplitude of 40 V is applied to the vertical deflecting plates of a CRT. A 250 Hz sawtooth wave with peak amplitude of 50 V is applied to the horizontal deflecting plates. The CRT has vertical deflection sensitivity of 0.1 cm/V and horizontal deflection sensitivity of 0.08 cm/V. Assuming that the two inputs are synchronized, determine the waveform displayed on the screen. [(CO1)(Analyse/IOCQ)]
- (b) Explain the working principle of a sampling oscilloscope with the help of proper block diagram. [(CO2)(Analyse/IOCQ)]
4 + 8 = 12
3. (a) Draw the block diagram of digital storage-type oscilloscope and describe the working of each block. [(CO2)(Understand/LOCQ)]
- (b) How can the phase difference between two input sine wave signals having same frequencies be measured by using CRO? [(CO1)(Understand/LOCQ)]
8 + 4 = 12

Group - C

4. (a) Explain capture range and lock range of PLL. [(CO3)(Analyse/IOCQ)]
- (b) Explain the applications of voltage to current converters. [(CO4)(Understand/LOCQ)]
- (c) Compare between analog and digital programmable gain amplifier. [(CO4)(Analyse/IOCQ)]
4 + 5 + 3 = 12
5. (a) With neat diagram, explain the operation of charge amplifier. [(CO4)(Analyze/IOCQ)]
- (b) With neat sketch, describe the operation of a frequency synthesizer circuit. [(CO3)(Understand/LOCQ)]
5 + 7 = 12

Group - D

6. (a) Explain the operation of digital spectrum analyzer. Mention its advantages over analog spectrum analyzers. [(CO5)(Understand/LOCQ)+(Remember/LOCQ)]
 (b) Compare between noise and interference. [(CO5)(Analyse/IOCQ)]
(6 + 3) + 3 = 12
7. (a) Compute the total harmonic distortion of a signal that contains a fundamental signal with an rms value of 10 V, a second harmonic with an rms value of 3 V, a third harmonic with an rms value of 1.5 V, and a fourth harmonic with an rms value of 0.6 V. [(CO5)(Analyse/IOCQ)]
 (b) Discuss the types of interferences and their effects in wave propagation. [(CO5)(Evaluate/HOCQ)]
3 + 9 = 12

Group - E

8. (a) With neat diagram, explain the operation of function generator. [(CO6)(Analyse/IOCQ)]
 (b) Discuss the role of virtual instrumentation in the engineering process. [(CO6)(Evaluate/HOCQ)]
7 + 5 = 12
9. (a) Assess the role of strip chart recorder in engineering applications. [(CO6)(Evaluate/HOCQ)]
 (b) Explain the functions of laser printer components. [(CO6)(Analyse/IOCQ)]
8 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	34.38	42.70	22.92

Course Outcome (CO):

After the completion of the course students will be able to

1. Gain the knowledge about the construction and working of CRO, waveform display and phase difference measurement of two signals by CRO.
2. Familiar with the working and applications of dual trace, dual beam oscilloscope, delayed time base oscilloscope, sampling oscilloscope, analog storage and digital storage oscilloscope.
3. Use phase locked loop, voltage to frequency converter and frequency to voltage converter for various applications.

4. Apply the voltage to current converter, current to voltage converter, programmable gain amplifier, and charge amplifier in their relevant field of applications.
5. Understand the working of different types of spectrum analyzers and distortion meters.
6. Acquire the knowledge of electronic ohmmeter, multimeter, signal generators and virtual instrumentation.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.