ELECTRONIC INSTRUMENTATION
(AEIE 3224)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

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

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) A sine wave having time period 4ms and V_{pp} = ±2volt is applied to the vertical deflecting plates of a CRT. If the vertical deflection sensitivity is 2 cm/volt, then at 1.5 ms the vertical deflection of the electron beam in cm will be
(a) 4.8 cm (b) 4 cm (c) 2 cm (d) 2.8 cm

(ii) In a CRT, the highest positive potential is given to
(a) cathode (b) focusing electrodes
(c) vertical deflecting plates (d) post-deflection acceleration anode.

(iii) The X and Y inputs of a CRO are respectively V sin ωt and $-V$ sin ωt. The resulting Lissajous pattern will be
(a) a straight line (b) a circle
(c) the shape of 8 (d) an ellipse.

(iv) The function of low pass filter in phase-locked loop
(a) Improves low frequency noise (b) Removes high frequency noise
(c) Tracks the voltage changes (d) Changes the input frequency.

(v) Voltage to current converter is also called as
(a) Current series positive feedback amplifier
(b) Voltage series negative feedback amplifier
(c) Current series negative feedback amplifier
(d) Voltage series positive feedback amplifier.

(vi) A spectrum analyser is a combination of
(a) narrow band super-heterodyne receiver and CRO
(b) signal generator and CRO
(c) oscillator and wave analyser
(d) VTVM and CRO

(vii) Modern electronic multimeters measure resistance by
(a) using an electronic bridge compensator for nulling
(b) forcing a constant current and measuring the voltage across the unknown resistor
(c) using a bridge circuit
(d) applying a constant voltage and measuring the current through the unknown resistor.

(viii) The type of noise phenomena that increases with increase in temperature is
(a) None of the mentioned (b) 1/f noise
(c) Schottky noise (d) Thermal noise.

(ix) Which is not the function of data loggers?
(a) Display (b) Online analysis
(c) Reporting (d) Control.

(x) The bandwidth of a magnetic tape recorder is
(a) higher than electronic recorder (b) higher than strip chart recorder
(c) lower than strip chart recorder (d) higher than ultraviolet recorder.

Fill in the blanks with the correct word

(xi) The time base signal in a CRO is _____.

(xii) A double beam oscilloscope has _____.

(xiii) The phase-locked loop tracks any change in input frequency in_____ state.

(xiv) Harmonic distortion is due to _____.

(xv) LabVIEW stand for _____.

Group - B

2. (a) Draw the block diagram of automatic time base of CRO. If the input to the vertical deflection amplifier is a sine wave then draw the outputs at each stages of the time base. *[(CO1)(Remember/LOCQ)(Understand/LOCQ)]*

(b) What is the purpose of hold-off circuit in automatic time base of a CRO? *[(CO1)(Understand/LOCQ)]*

(c) Compare between dual trace and dual beam oscilloscopes. *[(CO2)(Analyze/IOCQ)]*

(3 + 4) + 2 + 3 = 12

3. (a) What is the purpose of delayed time base oscilloscope? With neat block diagram and related signal waveforms explain its operation. *[(CO2)(Understand/LOCQ)(Analyze/IOCQ)]*

(b) Why blanking circuit is required? *[(CO1)(Understand/LOCQ)]*

(1 + 7) + 4 = 12

Group - C

4. (a) What is a VCO? With a neat block diagram, describe its working principle. *[(CO3)(Understand/LOCQ)]*

(b) Explain the operation of a rectifier type voltage to current converter with neat diagram. *[(CO4)(Analyze/IOCQ)]*

(1 + 5) + 6 = 12

5. (a) Discuss the applications of charge amplifier. *[(CO4)(Evaluate/HOCQ)]*

(b) List the uses of voltage to frequency and frequency to voltage converters? With neat diagram, explain the operation of both the converters. *[(CO3)(Remember/LOCQ)[(CO3)(Analyze/IOCQ)]*

2 + (2 + 8) = 12

Group - D

6. (a) With neat diagram, explain the operation of swept tuned radio frequency spectrum analyzer. *[(CO5)(Analyse/IOCQ)]*

(b) Describe the basic function of a distortion meter and discuss its frequency range. *[(CO5)(Understand/LOCQ)]*

8 + (2 + 2) = 12

7. (a) Draw the complete block diagram of fundamental-suppression distortion meter and describe its operation. *[(CO5)(Analyze/IOCQ)]*

(b) Discuss the role of spectrum analyzers in the field of electronics. *[(CO5)(Evaluate/HOCQ)]*

8 + 4 = 12

Group - E

8. (a) With neat diagram, explain the operation of series ohmmeter. What are the advantages of shunt ohmmeter over it? *[(CO6)(Analyze/IOCQ)/(Understand/LOCQ)]*

(b) Explain the importance of data logger in the field of instrumentation. *[(CO6)(Analyze/IOCQ)]*

(6 + 2) + 4 = 12

9. (a) Describe the operation of a square-wave generator. *[(CO6)(Understand/LOCQ)]*

(b) Compare between Virtual Instruments and Traditional Instruments. *[(CO6)(Analyse/IOCQ)]*

(c) List the Advantages of laser printers. *[(CO6)(Remember/LOCQ)]*

4 + 4 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	40.63	53.13	6.25

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.*