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
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> 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)   Sampling oscilloscopes are specially designed to measure
            (a) very high frequency   (b) very low frequency
            (c) microwave frequency   (d) none of these.

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

    (iii)   What is 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.

    (iv)   A frequency synthesizer is ___
            (a) a VCO phase locked to a reference frequency
            (b) a VFO phase locked to a reference frequency
            (c) a fixed RF generator
            (d) a variable RF generator.

    (v)   What is the frequency of the supplied alternating current in India?
            (a) 50 KHz   (b) 30 Hz
            (c) 50 Hz   (d) 60 Hz

    (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) A strip chart recorder is a/an
        (a) analog recorder   (b) magnetic tape recorder
        (c) oscillographic recorder   (d) none of the above.

(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.

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)(Analyze/IOCQ)]
    (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 it's operation.
                                                   [(CO2)(Understand/LOCQ)(Analyze/IOCQ)]
    (b) Why blanking circuit is required?   [(CO1)(Understand/LOCQ)]
                                                   (1 + 7) + 4 = 12

Group - C

4. (a) With a neat block diagram explain the operation of PLL as FM demodulator.
                                                   [(CO3)(Analyze/IOCQ)]
    (b) The half wave rectifier type voltage to current converter circuit uses a 1mA FSD meter with 1.2 kΩ coil resistance. Calculate the resistance connected between the inverting and common terminal to give full scale deflection for a 100 mV (rms) ac input. Also, determine the meter deflection for a 50 mV ac input.
                                                   [(CO4)(Analyze/IOCQ)]

(c) Justify the use of charge amplifier as signal conditioning circuit in piezoelectric transducer. [(CO4)(Evaluate/HOCQ)]

5 + 5 + 2 = 12

5. (a) List the uses of voltage to frequency and frequency to voltage converters?
[(CO3)(Remember/LOCQ)]
   (b) With neat diagram, explain the operation of both the converters.
[(CO3)(Analyze/IOCQ)]
   (c) What is the advantage of programmable gain amplifier over conventional amplifier? [(CO4)(Understand/LOCQ)]

2 + 8 + 2 = 12

Group - D

6. (a) Design the Swept Superheterodyne spectrum analyzer to analyze signals of frequency range 25 kHz to 500 kHz with an interval of 25 KHz. The screen of spectrum analyzer has 5 divisions. [(CO5)(Create/HOCQ)]
   (b) What is signal to noise ratio? What are the different types of noises?
[(CO5)(Remember/LOCQ)]

9 + 3 = 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) Discuss the importance of data logger in the field of instrumentation.
[(CO6)(Evaluate/HOCQ)]

(6 + 2) + 4 = 12

9. (a) Assess the usage of magnetic tape recorder in engineering applications.
[(CO6)(Evaluate/HOCQ)]
   (b) Evaluate the role of signal generators in electronics. [(CO6)(Evaluate/HOCQ)]

6 + 6= 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	16.67	51.04	32.29

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