

ELECTRONIC INSTRUMENTATION
(ELEC 4241)

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) 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 above.
 - (ii) What is the output voltage in a dual slope integrating type DVM?
(a) Differential of the input (b) Multiple of the input
(c) Integral of the input (d) Zero.
 - (iii) The main disadvantage of true r.m.s reading voltmeter is
(a) presence of transducer (b) presence of thermocouple
(c) presence of transformer (d) presence of oscillator.
 - (iv) What is the purpose of sampling in DSO operation?
(a) Control time base signal (b) Convert analog signal to digital
(c) Convert digital signal to analog (d) Visualize the signal on screen.
 - (v) The operating frequency range of an LCD is
(a) 30 Hz to 60 Hz (b) 50 Hz to 70Hz
(c) 10 Hz to 60 Hz (d) 100 Hz to 1 kHz
 - (vi) To measure liquid level by a capacitive transducer the principle of operation used is
(a) Change of distance between plates (b) Change of overlapping area of plates
(c) Change of dielectric constant (d) Both (a) and (c).
 - (vii) Q-meter works on the principle of
(a) mutual inductance (b) self inductance
(c) series resonance (d) parallel resonance.
 - (viii) The operating frequency range of a frequency selective wave analyzer is
(a) 20 Hz to 20 kHz (b) 2 kHz to 20 MHz
(c) 10 kHz to 18 MHz (d) 0 to 1 GHz.

- (ix) How many bits are required in a binary ladder type DAC to achieve a resolution of 10mV if full-scale is +5 V?
(a) 10 bits (b) 13bits (c) 9bits (d) 4 bits.
- (x) A platinum RTD has a resistance of 100Ω at 100°C. If the temperature coefficient is 0.004/°C, what would be the change in resistance if the temperature rise is 50°C?
(a) 10Ω (b) 15Ω (c) 20Ω (d) 25Ω.

Group - B

2. (a) What is voltage controlled oscillator? Explain with diagram, the working principle of a voltage controlled oscillator. [(CO1)(Understand/LOCQ)]
(b) What is a current mirror? Explain with diagram the working principle of a current mirror. [(CO1)(Analyze/IOCQ)]
6 + (2 + 4) = 12
3. (a) Draw the block diagram of a successive approximation type digital voltmeter and explain its operating principle. [(CO1)(Create/HOCQ)]
(b) Explain the necessity of two thermocouples used in true RMS reading voltmeter. [(CO1)(Evaluate/HOCQ)]
6 + 6 = 12

Group - C

4. (a) Explain the working principle of linear variable differential transformer with a proper figure. [(CO2)(Understand/LOCQ)]
(b) Explain how can a parallel-plate capacitor serve as a suitable transducer for measurement of linear and angular displacements. [(CO2)(Analyze/IOCQ)]
6 + 6 = 12
5. Write short notes on any two of the following:
(i) Power Factor Meters
(ii) Vector Voltmeters
(iii) Inductive sensors. [(CO2)(Understand/LOCQ)]
(6 + 6) = 12

Group - D

6. (a) What is a Wave Analyzer? [(CO3)(Remember/LOCQ)]
(b) Explain with the help of a block diagram the working principle of a Frequency Selective Wave Analyzer. [(CO3)(Evaluate/HOCQ)]
(c) List different salient applications of Wave Analyzer. [(CO3)(Remember/LOCQ)]
2 + 6 + 4 = 12
7. (a) What is Q-meter? State the different ways to connect an unknown coil with the Q-meter. [(CO3)(Evaluate/HOCQ)]

- (b) Discuss about different errors of Q-meter. [(CO3)(Analyze/IOCQ)]
(c) A coil with a resistance of 10Ω is connected with a Q-meter in direct connection mode. At resonance, oscillator frequency is 10MHz and resonating capacitor is set at 65pF. Calculate the % error introduced by 0.02Ω shunt resistance. [(CO3)(Analyze/IOCQ)]
(2 + 3) + 3 + 4 = 12

Group - E

8. (a) Draw and explain the block diagram of a Digital Data Acquisition System (DAS). [(CO4)(Understand/LOCQ)]
(b) Find the 4-bit binary representation of an analog signal of 3.26 Volt using successive approximation technique. Assume reference voltage is 5 Volt. (CO4)(Evaluate/HOCQ)
6 + 6 = 12
9. (a) What is 'Analog Multiplier'? State the different characteristics of 'Analog Multiplier'. [(CO4)(Analyze/IOCQ)]
(b) How can a square root extractor be constructed using 'Analog Multiplier'? [(CO4)(Create/HOCQ)]
(c) What is a 'virtual instrument'? State the salient advantages of virtual instruments. [(CO4)(Remember/LOCQ)]
(2 + 3) + 4 + 3 = 12
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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	40.62	25	34.38

Course Outcome (CO):

After the completion of the course students will be able to

- Infer about low current and voltage measurement using electronic instruments.
- Explain the applications of DSO and sensors
- Understand wave analyzing circuits and function generator.
- Acquire the concepts of data acquisition and virtual instrumentation.

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

