

# **ELECTRONIC INSTRUMENTATION (ELEC 4241)**

**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:

$$12 \times 1 = 12$$

*Choose the correct alternative for the following*

*Fill in the blanks with the correct word*

- (xi) VFCs are commonly used in \_\_\_\_\_ systems to convert analog signals into frequency-based signals.
- (xii) \_\_\_\_\_ is displayed on the x-axis of a spectrum analyzer.
- (xiii) The quality factor, or Q-factor, is defined as the ratio of \_\_\_\_\_ energy to dissipated energy in a reactive component.
- (xiv) A low-pass filter is used in DAS to remove \_\_\_\_\_ from the acquired signals.
- (xv) The operational amplifier used in a current-to-voltage converter must have a low \_\_\_\_\_ offset to ensure accurate measurements.

## **Group - B**

2. (a) What is the necessity of a true rms voltmeter? Why are two thermocouples used in a true rms voltmeter? *[(CO1) (Evaluate/HOCQ)]*  
(b) Explain the function of dual slope integrating type voltmeter. *[(CO1) (Analyze/LOCQ)]*  
 **$(3 + 3) + 6 = 12$**

3. (a) List the advantages and applications of frequency counters. *[(CO1) (Remember/LOCQ)]*  
(b) What is a current mirror? Explain with a diagram the working principle of a current mirror. *[(CO1) (Analyze/LOCQ)]*  
 **$4 + (2 + 6) = 12$**

## Group - C

4. (a) How liquid level change can be sensed by a capacitive sensor? Derive the expression of sensitivity. [(CO2)(Analyze/IOCQ)]

(b) What is the disadvantage if a solid dielectric medium is used in a variable distance capacitive sensor? [(CO2) (Understand/LOCQ)]  
 (c) Describe the function of a resistive potentiometer as a sensor. [(CO2) (Evaluate/HOCQ)]  
**5 + 5 + 2 = 12**

5. (a) Describe the different modes of operation of piezoelectric transducers. What are the properties of materials used for piezoelectric transducers? Mention the applications of piezoelectric transducer. [(CO2)(Remember/LOCQ)]  
 (b) Explain with figure how very low voltage measurement is done with chopper stabilized amplifier. [(CO2)(Understand/LOCQ)]  
**(3 + 2 + 2) + 5 = 12**

### Group - D

6. (a) A circuit consists of a coil, a resistance and a variable capacitor connected in series is tuned to resonance using a Q meter. If the frequency is 500kHz, the resistance is  $0.5\Omega$  and the variable capacitor is  $350\text{pF}$ , calculate the effective inductance and resistance of the coil, if the Q-meter indicates 90. [(CO3)(Analyze/HOCQ)]  
 (b) Discuss about the applications of Q-meter. [(CO3)(Understand/LOCQ)]  
**6 + 6 = 12**

7. (a) Explain the working principle of Heterodyne Wave Analyzer. [(CO3) (Analyze/IOCQ)]  
 (b) List the different applications of Wave Analyzer. [(CO3) (Analyze/IOCQ)]  
 (c) Explain with the help of a block diagram, the working principle of a 'Spectrum Analyzer'. [(CO3) ((Understand/LOCQ)]  
**3 + 3 + 6 = 12**

### Group - E

8. (a) What are the goals of the data acquisition system? Describe various types of data acquisition systems with proper diagrams. [(CO4)(Analyze/IOCQ)]  
 (b) What is a 'virtual instrument'? [(CO4)(Remember/LOCQ)]  
**(2 + 8) + 2 = 12**

9. (a) A 4-bit DAC has a reference voltage of 10V. Determine the output voltage for a digital input of  $1011_2$  using the weighted resistor method. What is the resolution of this DAC? [(CO4) (Evaluate/HOCQ)]  
 (b) Define multiplexing and describe the working principles of Digital-to-Analog Multiplexing and Analog-to-Digital Multiplexing with suitable block diagrams. [(CO4)(Remember/LOCQ)]  
**4 + (2 + 6) = 12**

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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	42.71	36.46	20.83

