

**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 × 1 = 12

Choose the correct alternative for the following

- (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 purpose of sampling in DSO operation?
 - (a) Control time base signal
 - (b) Convert analog signal to digital signal
 - (c) Convert digital signal to analog signal
 - (d) Visualize the signal on screen.
- (iii) Q-meter is used to measure
 - (a) electrical properties of the capacitors only
 - (b) electrical properties of both the coils and the capacitors
 - (c) mechanical properties of the coil only
 - (d) electrical properties of the coil only.
- (iv) In a true r.m.s. reading voltmeter meter reading is obtained by
 - (a) sensing current
 - (b) sensing power
 - (c) sensing voltage
 - (d) sensing resistance.
- (v) The order in which the temperatures transducer exhibit nonlinearity (from highest to lowest) is
 - (a) Thermocouple, RTDs, Thermistor
 - (b) Thermistor, Thermocouple, RTDs
 - (c) RTDs, Thermocouple, Thermistor
 - (d) Thermistor, RTDs, Thermocouple.
- (vi) The operating frequency range of LCDs is
 - (a) 30Hz to 60 Hz
 - (b) 50Hz to 70Hz
 - (c) 10Hz to 60 Hz
 - (d) 100Hz to 1Khz.

- (vii) In an LVDT, the two secondary windings are connected in differential form to obtain
 (a) higher output voltage
 (b) an output voltage which is phase sensitive
 (c) in order to establish the null point for the displacement of the core
 (d) both (b) and (c).
- (viii) The operating frequency range of Heterodyne wave analyzer is
 (a) 20Hz to 20kHz (b) 20kHz to 20MHz
 (c) 10kHz to 18MHz (d) 0 to 1GHz
- (ix) To measure liquid level by a capacitive transducer the principle of operation used is
 (a) Change of distance between plates (b) Change of area of plates
 (c) Change of dielectric constant (d) Both (a) and (c).
- (x) How many bits are required in a binary ladder type DAC for a resolution of 1mV if full-scale is +5 V?
 (a) 10 bits (b) 13 bits (c) 9 bits (d) 4 bits.

Fill in the blanks with the correct word

- (xi) MEMS stands for _____.
- (xii) The function which is performed by the sample/hold circuit along with the ADC in a digital storage oscilloscope is _____.
- (xiii) The function which makes a stable waveform displayed on the DSO screen _____.
- (xiv) An example of a passive transducer is _____.
- (xv) A voltmeter using thermocouple measures _____.

Group - B

2. (a) With a suitable block diagram explain the working of frequency counters. [[C01](Understand/LOCQ)]
 (b) Explain with a neat circuit diagram the working principle of a dual slope digital voltmeter (DVM). [[C01](Apply/IOCQ)]
6 + 6 = 12
3. (a) Build the block diagram of True RMS voltmeter and explain it. [[C01]](Apply/IOCQ)]
 (b) What is current mirror? Explain with a diagram the working principle of a current mirror. [[C01](Analyse/IOCQ)]
5 + (2 + 5) = 12

Group - C

4. (a) Explain how the operation of an LVDT depends on the position of the core. [[C01](Analyse/HOCQ)]

- (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 + 3 + 4 = 12**
5. (a) Write a short note on any one of the following:
 (i) MEMS
 (ii) Digital Displays. [[CO2](Understand/LOCQ)]
- (b) What is a thermistor? Explain with proper figure and expression, the resistance-temperature characteristic of a thermistor. [[CO2](Understand/LOCQ)]
- 6 + (2 + 4) = 12**

Group - D

6. (a) What is a Wave Analyzer? Explain with the help of a block diagram the working principle of a Frequency Selective Wave Analyzer. [[CO3](Analyse/HOCQ)]
- (b) Explain with the help of a block diagram, the working principle of a 'Spectrum Analyzer'. [[CO3](Understand/LOCQ)]
- (2 + 5) + 5 = 12**
7. Write short notes on:
 (i) Q-meter
 (ii) Function Generator. [[CO3](Apply/IOCQ)]
- (6 + 6) = 12**

Group - E

8. (a) What are the goals of a data acquisition system? Describe various types of data acquisition systems with proper diagrams. [[CO4](Analyse/IOCQ)]
- (b) What is a 'virtual instrument'? [[CO4](Remember/LOCQ)]
- (2 + 8) + 2 = 12**
9. (a) What does "multiplexing" mean? Describe the concepts of "digital to analog" and "analog to digital" multiplexing with proper block diagrams. [[CO4](Analyse/HOCQ)]
- (b) What is an 'Analog Multiplier'? State the different characteristics of 'an Analog Multiplier'. [[CO4](Analyse/IOCQ)]
- (2 + 6) + (2 + 2) = 12**

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	29.16	45.84	25

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 generators.
- Acquire the concepts of data acquisition and virtual instrumentation.

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