

International Islamic University Chittagong
Department of Electrical and Electronic Engineering
B. Sc. Engineering in EEE

Semester End Exam, Autumn 2023

Course Code: **EEE 4827**

Course Title: **Measurement and Instrumentation**

Time: 2 hours 30 minutes

Full Marks: 50

- (i) The figures in the right-hand margin indicate full marks
(ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

CO	CO Statements
CO1	Reflect a basic understanding of measurement system, measuring instruments, converters, and application of instruments in measuring electrical and non-electrical quantities.
CO2	Demonstrate basic proficiency in developing converters, and design measurement system for electrical and non-electrical quantities.
CO3	Apply the necessary learning skills in industrial electrical and various non electrical measurements and data processing sector.

Bloom's Levels (BL) of the Questions						
Letter Symbols	C1	C2	C3	C4	C5	C6
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Part A

[Answer the questions from the followings]

- | | | | |
|--|-----|----|---|
| 1. a) Compare between active and passive transducer. Explain how LVDT acts as a transducer to convert non-electrical parameter into electrical quantity. | CO2 | C4 | 7 |
| 1. b) Derive the equation for gauge factor for strain gauge. | CO2 | C5 | 3 |
| 2. a) Design a fluid flow measurement system using ultrasonic method showing necessary calculation. What are the limitations of this method? | CO2 | C6 | 5 |
| 2. b) Design an inductive pressure measurement system showing necessary calculation. | CO2 | C6 | 5 |

Or,

- | | | | |
|---|-----|----|---|
| 2. a) Design a liquid level measurement system using capacitive method. | CO2 | C6 | 5 |
| 2. b) Design three lead temperature measurement system. | CO2 | C6 | 5 |

Part B

[Answer the questions from the followings]

- | | | | |
|--|-----|----|---|
| 3. a) Explain motion balance current telemetry system. | CO3 | C4 | 3 |
| 3. b) i. The tuned circuit in a simple A.M. transmitter uses a 50μH inductance and 1μF capacitance. If the oscillator output is modulated by radio frequencies up to 10 KHZ, what is the frequency range occupied by side bands? | CO3 | C2 | 3 |
| ii. Show that the total power of an amplitude modulated signal can be a maximum of 1.5 times of the carrier power. | CO3 | C4 | 4 |
| 4. a) Why noise cannot be completely eliminated? Discuss some noise limiting techniques. | CO3 | C4 | 4 |
| 4. b) What is the maximum power of thermal noise? Represent the thermal noise in terms of a Thevenin voltage source with a noiseless resistor. Show that the noise factor, $F = 1 + \frac{N_a}{A_p N_i}$ | CO3 | C3 | 6 |

P.T.O

5. a) Design a digital-to-analog converter showing its circuitry. Use resolution, $K=1$ for your design. CO3 C6 5
5. b) What is *sampling*? Why is it used? Assume the following values for a digital ramp ADC: CO3 C3 5
 Clock frequency = 1 MHz
 $V_T = 0.1$ mV
 DAC has full scale output = 10.23 V and a 10-bit input.
 Find the following values:
 a) The digital equivalent obtained for $V_A = 3.728$ V
 b) The conversion time.

Or,

5. a) Design and explain a successive-approximation analog-to-digital converter. CO3 C6 5
5. b) Figure 5(b). Shows a computer controlling the speed of a motor. The 0-2 mA current from DAC is amplified to produce motor speed from 0 to 1000 rpm. How many bits should be used if the computer is to be able to produce a motor speed that is within 2 rpm of the desired speed? Using smallest number of bits, how close to 326 rpm can the motor speed be adjusted? CO3 C4 5

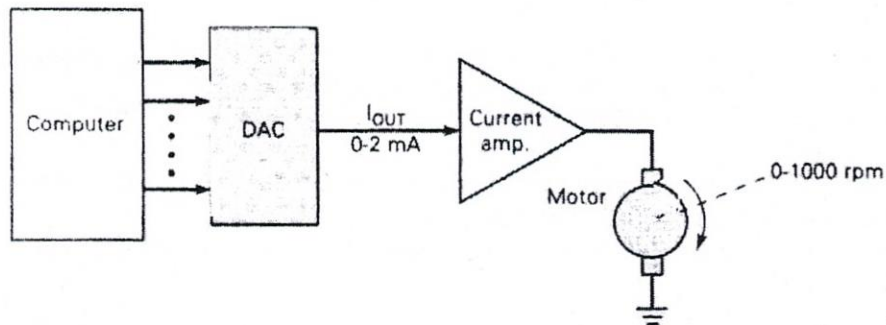


Figure 5(b).