

**International Islamic University Chittagong**  
**Department of Electrical and Electronic Engineering**

B.Sc. Engineering in EEE

Midterm Examination, Autumn 2023

Course Code: **EEE 4827**

Course Title: **Measurement and Instrumentation**

Time: 1 hour 30 minutes

Full Marks: 30

(i) Answer all the questions. The figures in the right-hand margin indicate full marks.

(ii) Course Outcomes (COs) and Bloom's Levels (BL) 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

- |       |      |   |     |    |   |
|-------|------|---|-----|----|---|
| 1) a) | i.   | Evaluate the accuracy, sensitivity, and suitability of deflection type and null type instruments in different situations.   | CO1 | C2 | 5 |
|       | ii.  | Describe the general functions of a measurement and instrumentation system.   |     |    |   |
| 1) b) | i.   | <b>Identify</b> the fundamental components of a generalized instrumentation system. Sketch the different blocks and describe how they work.   | CO1 | C4 | 5 |
|       | ii.  | <b>Compare</b> among mechanical, electrical and electronic instruments. What are the major functions of these instruments in all branch of Engineering?   |     |    |   |
| 2) a) |      | <b>Derive</b> the torque equation for electro-dynamometer instruments.  | CO1 | C5 | 5 |
| 2) b) |      | A moving coil ammeter has a fixed shunt of $0.02 \Omega$ with a coil resistance, $R_m = 1000 \Omega$ and a potential difference of $500 mV$ across it, full scale deflection is obtained. Find: | CO1 | C3 | 5 |
|       | i.   | The shunt current it corresponds.   |     |    |   |
|       | ii.  | Calculate the value of $R_m$ to give full scale deflection when the shunt current is $10 A$ .   |     |    |   |
|       | iii. | Value of $R_m$ when 40% deflection is obtained with current, $I=100 A$ .  |     |    |   |

OR

- 2) a) Point out the essential requirements of an analog current measuring instrument for a successful measurement? Derive the equation for a shunt resistor in a PMMC ammeter. CO1 C5 5
- 2) b) A moving coil voltmeter with a resistance of  $20 \Omega$  gives full scale deflection of  $120^\circ$  when a potential difference of  $100\text{mV}$  is applied across it. The moving coil has dimensions of  $30 \text{ mm} \times 25 \text{ mm}$  and is wound with 100 turns. The control spring constant is  $0.375 \times 10^{-6} \text{ Nm/deg}$ . Measure the flux density in the air gap. Also, find the diameter of the copper coil winding if 30% of the instrument resistance is due to coil winding. The specific resistance for copper is  $= 1.7 \times 10^{-8} \Omega\text{m}$ . CO1 C3 5
- 3) a) i. Why can not the PMMC measure AC current, and how may a rectifier aid in that situation? Point out the advantages and disadvantages of instrument transformer? CO2 C4 5  
ii. Show that, a full-wave rectifier has twice the sensitivity of a half-wave rectifier.
- 3) b) i. What complications arise from monitoring current and voltage in a high voltage transmission line using low rating instruments? CO2 C4 5  
ii. Find the tools are actually needed to be employed in that situation? How are they wired together in a circuit to be measured?