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Bengaluru

Mid Term Examinations - October 2026

Date: 07/10/2026 **Time:** 09:30 AM - 11:00 AM

Course Code: EEE2505 **Course Name:** Electrical and Electronics Measurements and Instrumentation

Semester: Fifth Semester **Max. Marks:** 50 **Weightage:** 50%

CO - Levels	CO1	CO2
Marks	24	66

PART A: Answer Following Questions. 10 M

Q.N.	Questions	M	CO	BT
1	A pressure transmitter used in an industrial process has a measuring range of **0–500 kPa** and an accuracy specification of **±1% of full scale**. Determine the **maximum permissible measurement error**.	2	CO1	BT3
2	During repeated testing of a voltage source, an instrument records **48 V, 50 V, 49 V, 51 V and 52 V**. Determine the **range of the measurements**.	2	CO1	BT3
3	During commissioning of a DC motor test bench, a PMMC ammeter has a full-scale deflection current of **1 mA** and internal resistance of **100 Ω**. The instrument must be converted to a **0–5 A ammeter**. Determine the required shunt resistance.	2	CO2	BT3
4	In an insulation-testing laboratory, a **Schering Bridge** is used to determine an unknown capacitance. At balance, the applicable relation is $Cx=CsR4/R3$. If $Cs=0.1\mu F$, $R3=100k\Omega$, and $R4=10k\Omega$, determine Cx .	2	CO2	BT3
5	Wheatstone bridge is used. The bridge arms are $R1=100\Omega$ **,** $R2=200\Omega$ **,** $R3=150\Omega$ and Rx is unknown. If the bridge is balanced, determine Rx .	2	CO2	BT2

PART B : Answer Any 1 Following Questions. 10 M

Q.N.	Questions	M	CO	BT
6	A pressure transmitter is installed in an industrial hydraulic system for monitoring process pressure. The transmitter has a measurement range of 0–400 bar and an accuracy specification of ±1.5% of full-scale value. During operation, the transmitter indicates a pressure of 250 bar. Determine: a) The full-scale value of the instrument. (1 Mark) b) The maximum permissible absolute error. (2 Marks) c) The possible true pressure range corresponding to the indicated value of 250 bar. (3 Marks) d) Calculate the percentage of full-scale error represented by the maximum permissible error. (2 Marks) e) Explain whether the transmitter is suitable if the process requires pressure measurement within ±4 bar. (2 Marks)	10	CO1	BT3

7	A temperature transmitter used in an industrial process produces an output voltage of 0.4 V at 20°C and 2.8 V at 140°C. Assume that the transmitter has a linear static characteristic over this range. As a calibration engineer: a) Calculate the change in output voltage. (2 Marks) b) Calculate the change in temperature. (1 Mark) c) Determine the static sensitivity of the transmitter in V/°C and mV/°C. (3 Marks) d) Derive the calibration equation relating output voltage to temperature . (2 Marks) e) Determine the expected output voltage at 90°C and comment on whether the transmitter can be calibrated using the obtained equation. (2 Marks)	10	CO1	BT3

PART C: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
8	A **power distribution company** is installing analog instruments at substations. The instrumentation engineer must select suitable instruments for: 1. DC battery-bank current 2. AC feeder current 3. AC/DC laboratory reference measurement The available instruments are: • PMMC • Moving Iron • Electrodynamometer **Tasks** **a)** Select the most suitable instrument for each application. **(3 Marks)** **b)** Compare the three instruments based on operating principle, AC/DC capability and accuracy. **(4 Marks)** **c)** Justify each selection from an industrial engineering perspective. **(3 Marks)**	10	CO2	BT3
9	An industrial temperature sensor has an unknown resistance. During calibration, it is connected to a Wheatstone bridge. The bridge has: • $R1=100\,\Omega$ • $R2=200\,\Omega$ • $R3=150\,\Omega$ • Rx= unknown At balance, the galvanometer shows zero deflection. **Tasks** **a)** Calculate the unknown resistance Rx . **(5 Marks)** **b)** Explain the physical meaning of zero galvanometer deflection. **(2 Marks)** **c)** Explain the balance condition of the Wheatstone bridge. **(3 Marks)**	10	CO2	BT3

PART D: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
10	A **precision instrumentation laboratory** needs to measure: 1. Precision resistance 2. Unknown inductance 3. High-quality capacitor The available bridges are: • Wheatstone Bridge • Maxwell Bridge • Schering Bridge **Tasks** **a)** Select the appropriate bridge for each measurement. **(3 Marks)** **b)** Explain the operating principle of each selected bridge. **(3 Marks)** **c)** Justify the selections based on accuracy and industrial application. **(4 Marks)**	10	CO2	BT2

11	A **high-voltage cable manufacturing company** uses a Schering Bridge to evaluate the insulation quality of its cables. For a particular bridge configuration, the balance equations are: $Cx=CsR4R3$ and $\tan\delta=\omega CxR4$ Given: • $Cs=0.1\,\mu F$ • $R3=100\,k\Omega$ • $R4=10\,k\Omega$ • Frequency $f=1\,kHz$ **Tasks** **a)** Determine the unknown capacitance Cx . **(4 Marks)** **b)** Calculate the dissipation factor $\tan\delta$. **(4 Marks)** **c)** Explain what a high dissipation factor indicates about cable insulation. **(2 Marks)**	10	CO2	BT3

PART E: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
12	An **automobile manufacturing company** is establishing an electrical testing laboratory for testing motors, batteries, sensors and electrical components. The laboratory must measure: • Current • Voltage • Resistance • Inductance • Capacitance **Tasks** **a)** Recommend a suitable instrument/bridge for each measurement. **(5 Marks)** **b)** State the operating principle of each selected instrument. **(3 Marks)** **c)** Justify the selections based on accuracy, sensitivity and industrial suitability. **(2 Marks)**	10	CO2	BT3
13	A **transformer manufacturing plant** needs to determine the inductance and resistance of an R–L test coil. A Maxwell Bridge is used. At bridge balance: • $R2=500\,\Omega$ • $R3=200\,\Omega$ • $R4=100\,\Omega$ • $C4=10\,\mu F$ For the bridge arrangement used, the balance equations are: $Rx=R2R3R4$ $Lx=R2R3C4$ **Tasks** **a)** Calculate Rx . **(3 Marks)** **b)** Calculate Lx . **(4 Marks)** **c)** Explain why Maxwell Bridge is suitable for medium-Q inductors. **(3 Marks)**	10	CO2	BT3