REG.NO.:

VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SLOT: D2+TD2

SCHOOL OF ELECTRICAL ENGINEERING
WINTER SEMESTER 2025-2026
CONTINUOUS ASSESSMENT TEST - II

Programme Name & Branch	: B. Tech. Electronics & Instrumentation	
Course Code and Course Name	: BEIE201L & Sensors and Signal Conditioning	
Faculty Name(s)	: Dr. YUVAPRIYA T	
Class Number(s)	: VL2025260504410	
Date of Examination	: 18/03/2026	
Exam Duration	: 90 minutes	Maximum Marks: 50

General instruction(s):

Answer All Questions

- Rough work should not be done on question paper. It will be treated as malpractice.
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Course Outcomes Statements:

CO. 2: Apply various types of resistive and reactance variation sensors in real time applications.

CO. 3: Interpret the design aspects of signal conditioning circuits for resistive and reactance variation sensors.

CO. 4: Analyze the self-generating sensors and associated signal conditioning circuits.

Q. No	Question	M	CO	BL
1.	a) In a variable reluctance type proximity inductive sensor, the coil has an inductance of 3000 μH when the target made of ferromagnetic material is 2 mm away from the core. Calculate the value of inductance when a displacement of 0.04 mm is applied to the target in a direction moving it towards the core. Neglect the reluctance of the iron parts.	5	2	4
	b) In a variable reluctance transducer, the coil has an inductance of 4.5 mH when effective turns on the coil are 80. Determine the inductance of the coil when the measurand makes the effective turns on the coil are 56.	5	2	4
2.	a) A seven-plate capacitive transducer has plates with dimensions 40 mm × 40 mm, and the distance between adjacent plates is 0.45 mm. The device is used for displacement measurement. Calculate the sensitivity of the transducer arrangement, assuming air as the dielectric medium between the plates.	5	2	4
	b) A capacitance transducer consists of two parallel plates with an overlapping area of 8×10^{-4} m^2 and is immersed in water. The measured capacitance is 12.50 pF. Determine: 1. The separation distance (d) between the plates. 2. The sensitivity of the transducer	5	2	4

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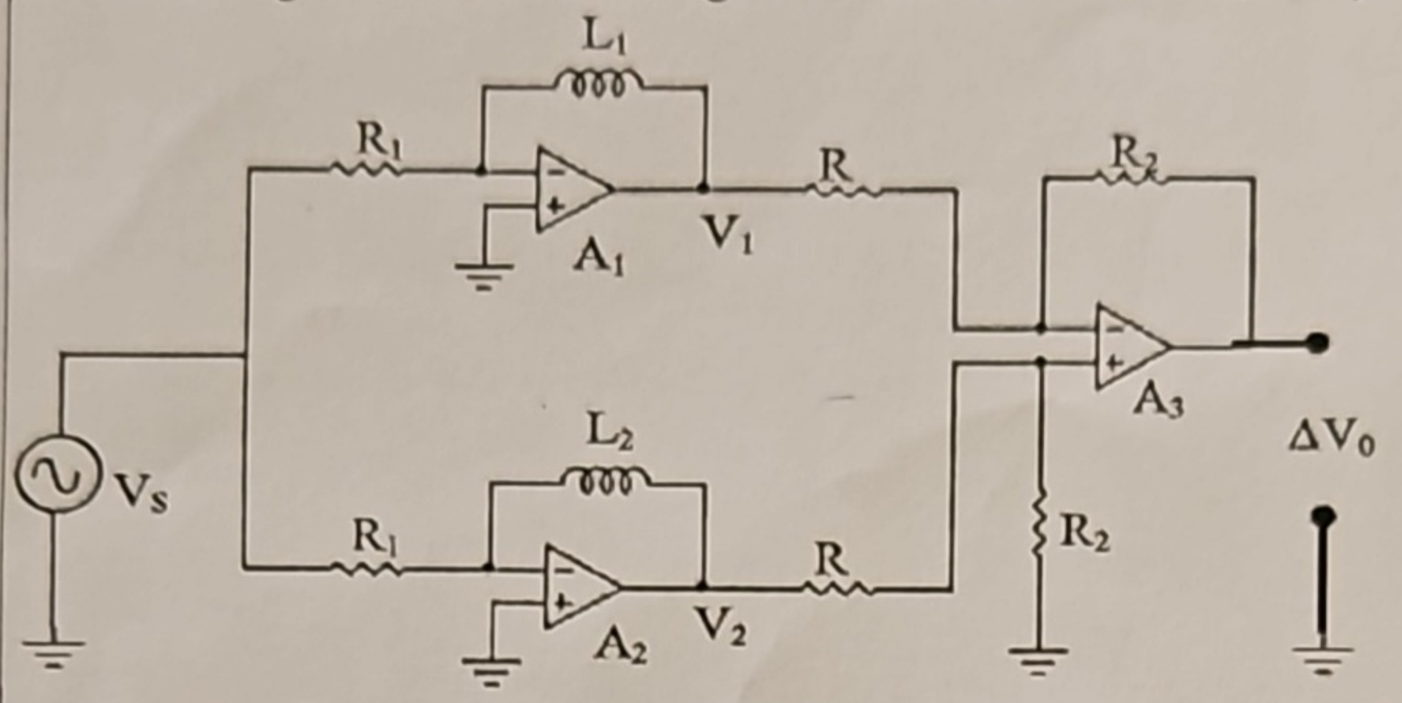
3.	Explain the operation of the following circuit with respect to any application. Derive the expression for output voltage for an inductive sensor signal conditioning circuit shown in Figure. what is the role of dummy inductor?  	10	3	5
4.	A Maxwell's inductance–capacitance bridge is used to measure an unknown inductive impedance. The bridge constants at bridge balance are: Pure resistance arms = 4.5 kΩ and 80 kΩ. In between these two resistors, the third arm has a capacitor of value 0.022 μF in series with a resistor of value 250 kΩ. Find the series equivalent of the unknown impedance.	10	3	4
5.	A quartz crystal of thickness 2 mm and area 400 mm² has a charge sensitivity of 2.3×10^{-12} C/N. If a force of 800 N is applied: 1. Calculate the charge developed. 2. If the crystal capacitance is 1500 pF, determine the output voltage. 3. Discuss why a charge amplifier is preferred over a voltage amplifier.	10	4	3