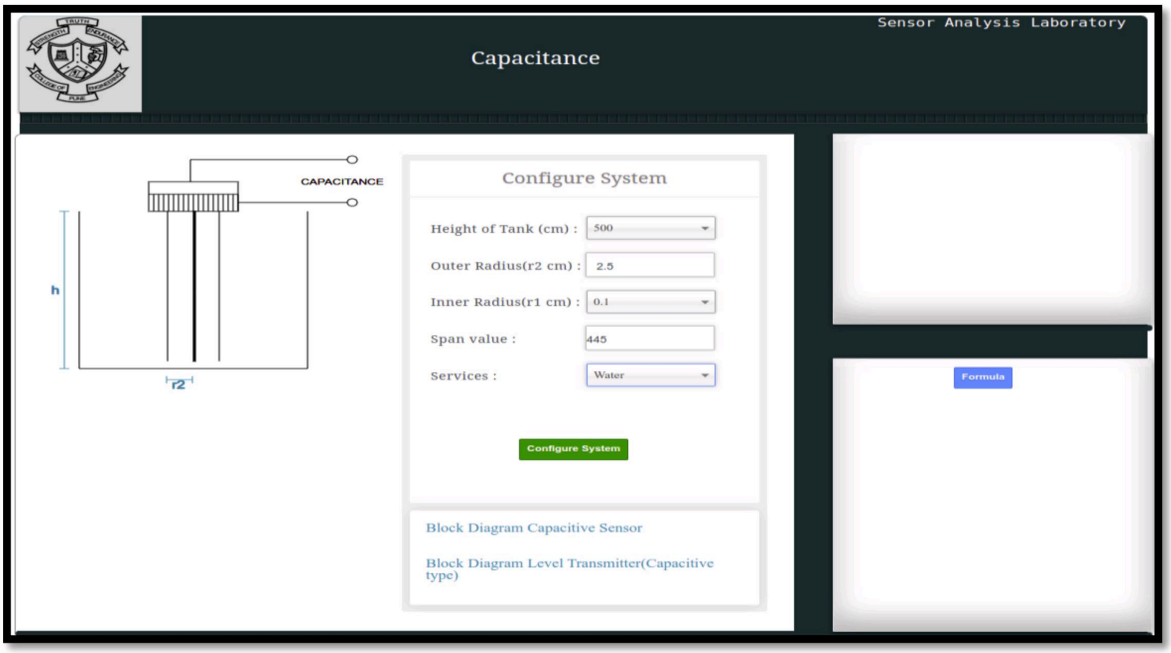
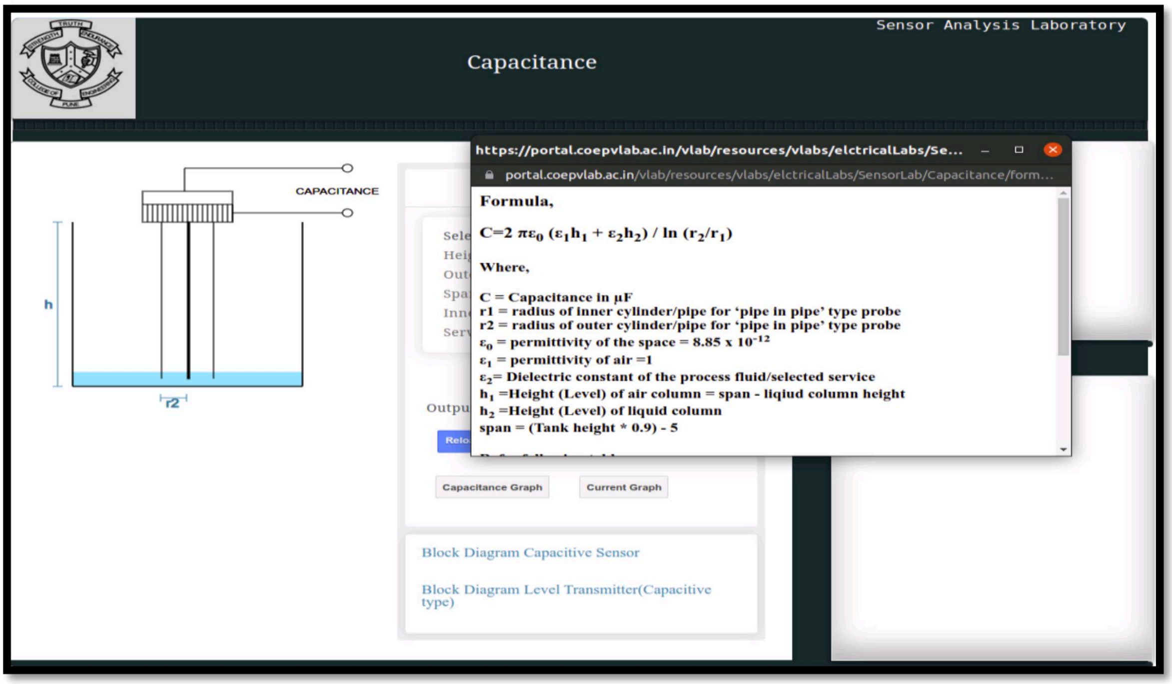
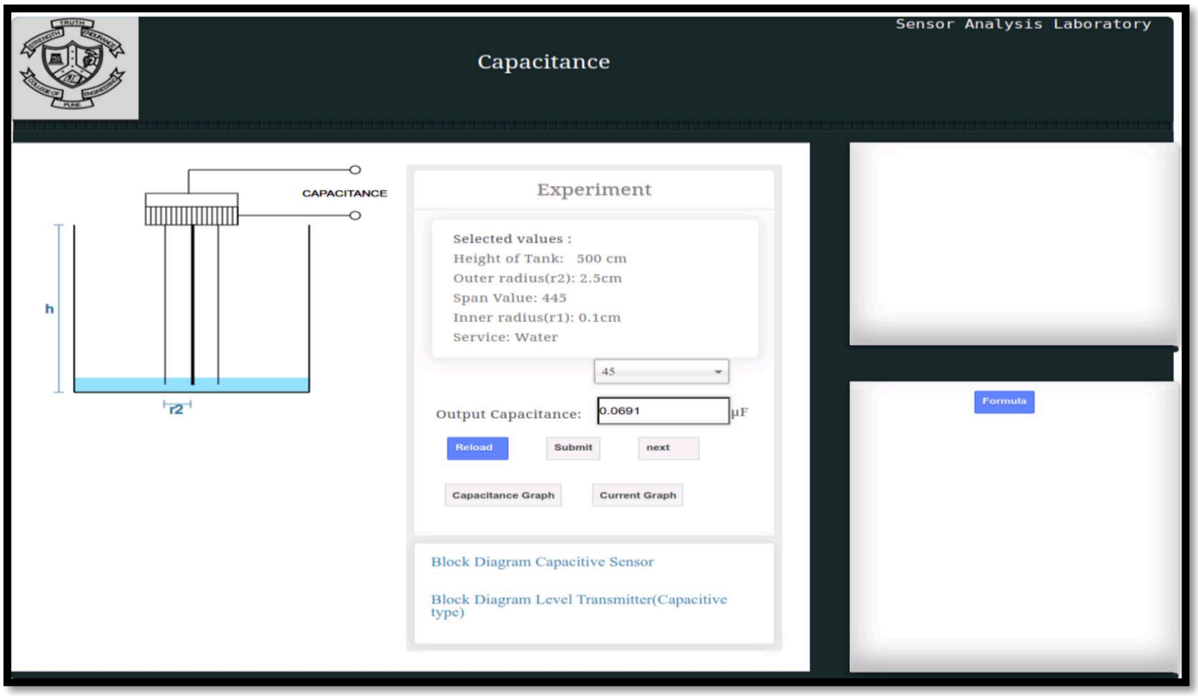
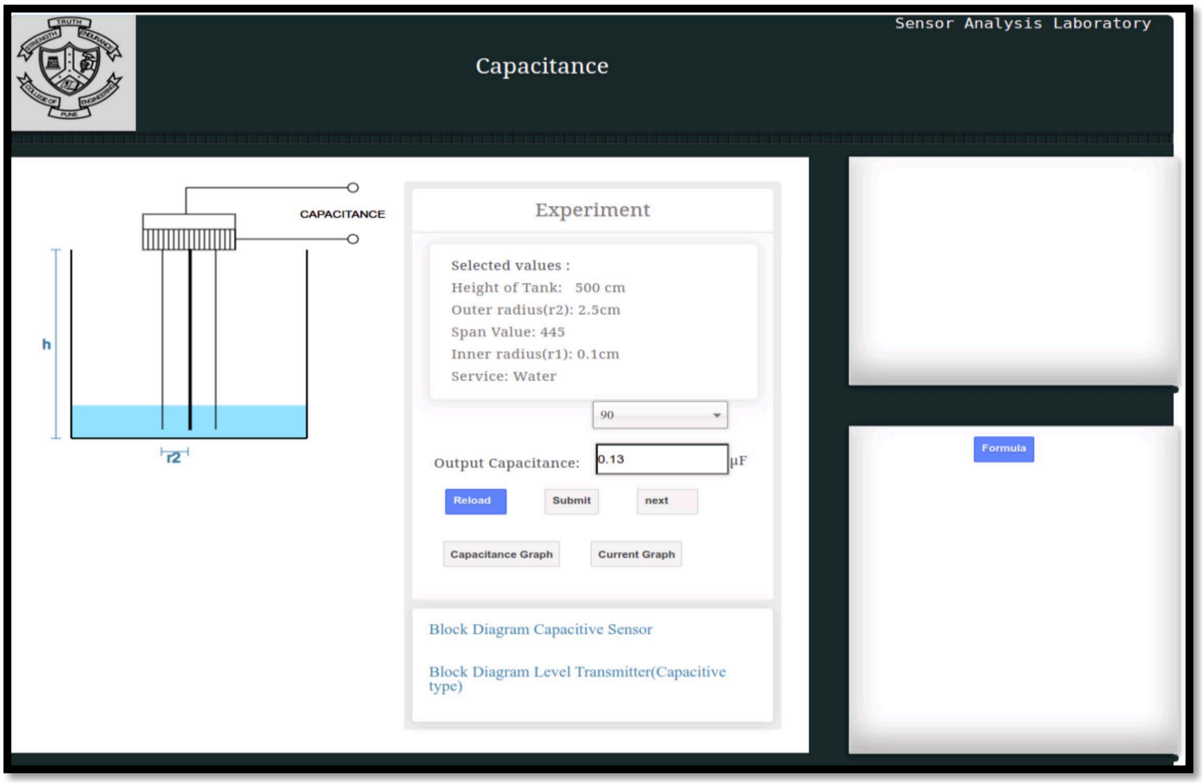
# ***SENSORS AND AUTOMATION***

***PRACTICAL NO : 3 : MEASUREMENT OF WATER LEVEL IN A TANK USING CAPACITIVE TYPE LEVEL PROBE.***



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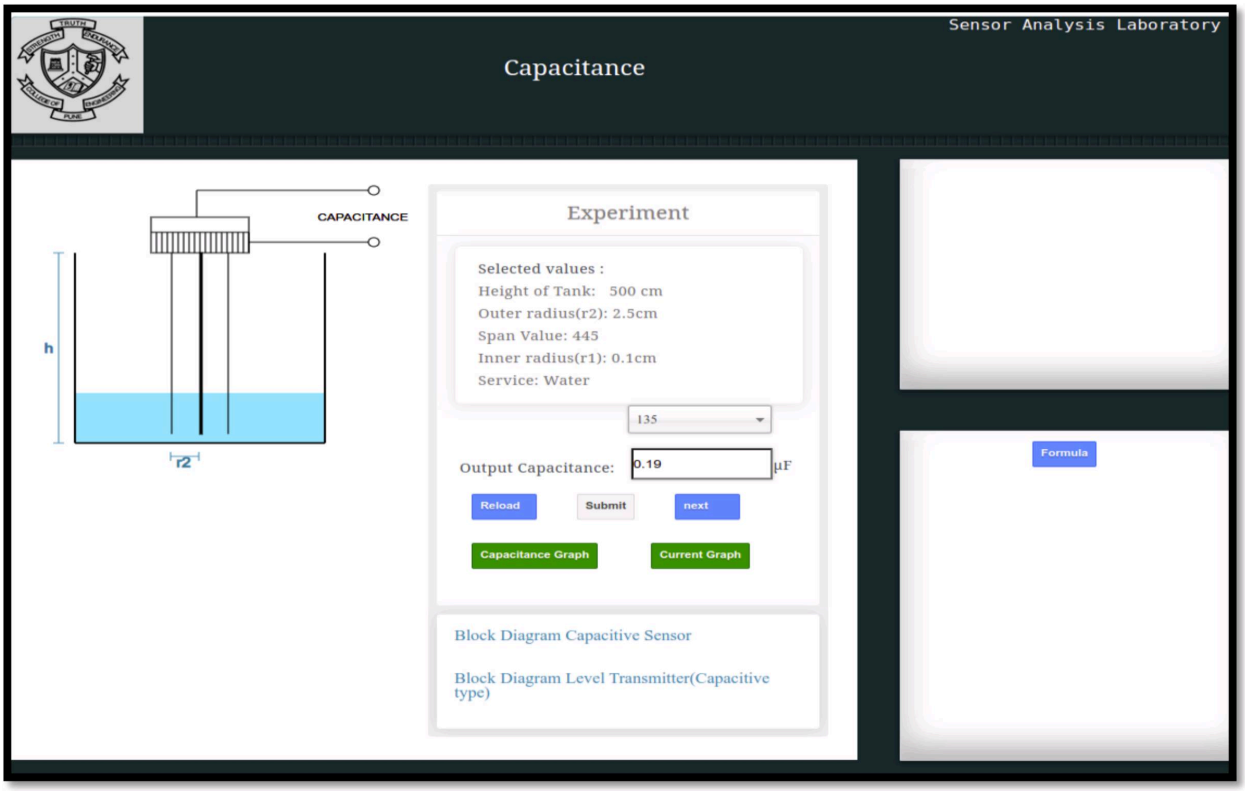
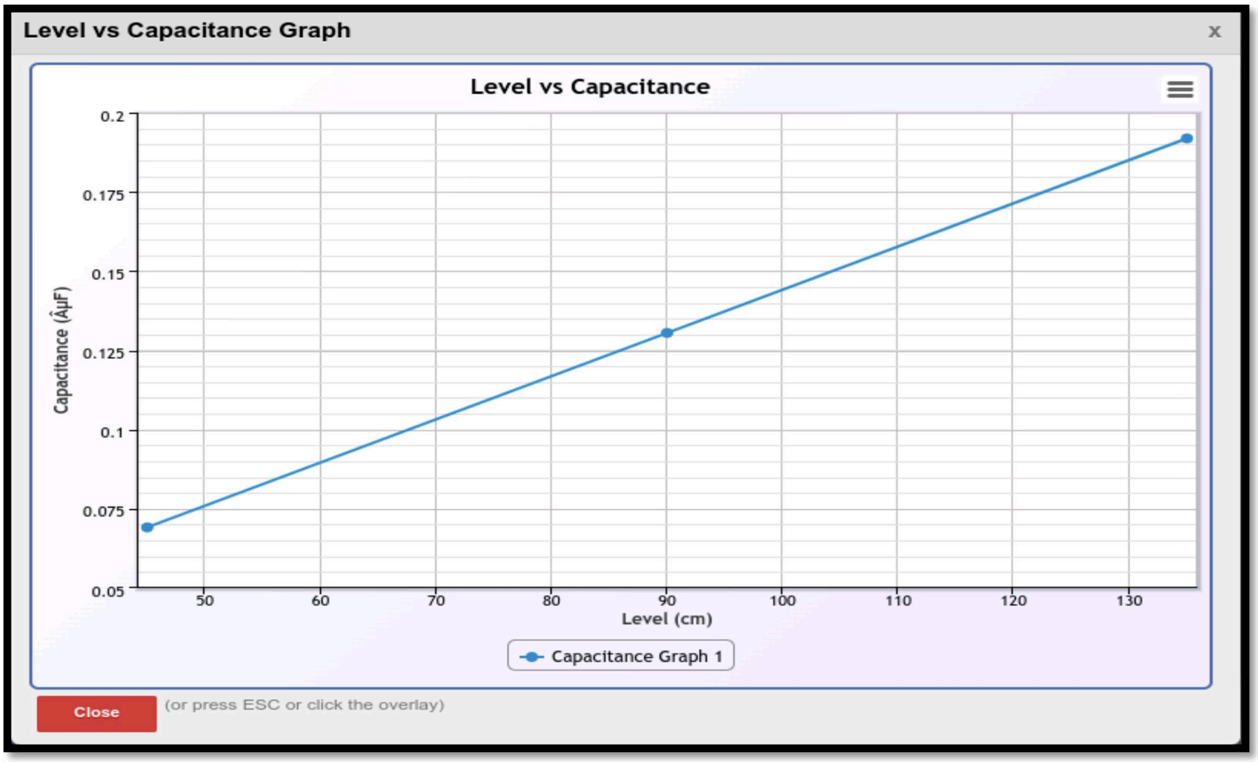
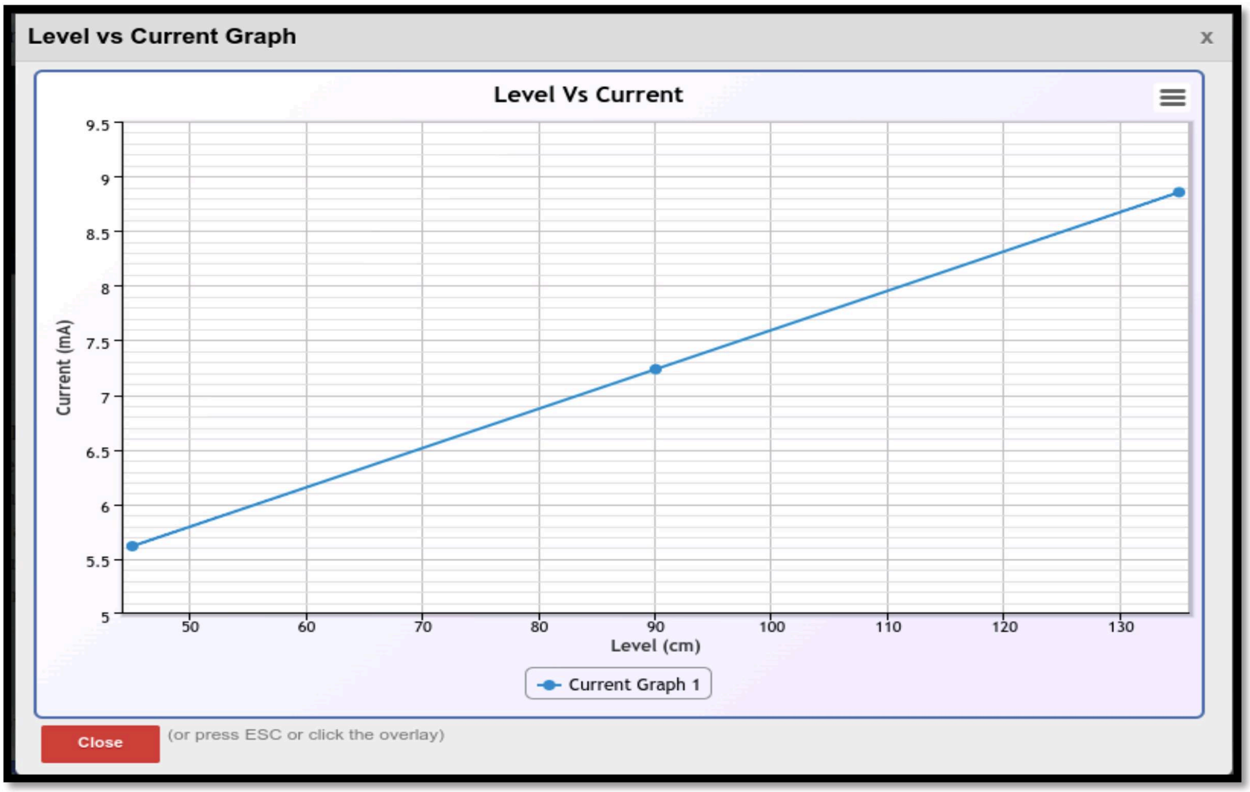

Sensor Analysis Laboratory
Capacitance
CAPACITANCE
h
r2
Experiment
Selected values :
Height of Tank: 500 cm
Outer radius(r2): 2.5cm
Span Value: 445
Inner radius(r1): 0.1cm
Service: Water
135
Output Capacitance: 0.19 µF
Reload
Submit
next
Capacitance Graph
Current Graph
Block Diagram Capacitive Sensor
Block Diagram Level Transmitter(Capacitive type)
Formula

**Graphs:**


Level vs Capacitance Graph
Level vs Capacitance
Capacitance (ÂµF)
Level (cm)
Capacitance Graph 1
Close
(or press ESC or click the overlay)


Level vs Current Graph
Level Vs Current
Current (mA)
Level (cm)
Current Graph 1
Close
(or press ESC or click the overlay)

# Sensors and Automation
## Assignment No: 3

- Measurement of Level in a Tank using Capacitive Type Level Probe.

Formula:

$$C = 2\pi\varepsilon_0(\varepsilon_1 h_1 + \varepsilon_2 h_2) / \ln(r_2/r_1)$$

where,

$C$ = Capacitance in $\mu F$

$r_1$ = radius of inner cylinder / pipe for 'pipe in pipe' type probe

$r_2$ = radius of outer cylinder / pipe for 'pipe in pipe' type probe.

$\varepsilon_0$ = permittivity of ~~air~~ space = $8.85 \times 10^{-12}$

$\varepsilon_1$ = permittivity of air = 1

$\varepsilon_2$ = Dielectric constant of the process fluid / selected service

$h_1$ = Height (Level) of air column = Span - liquid column height

$h_2$ = Height (Level) of liquid column

span = (Tank height * 0.9) - 5

| Process Fluid / Service | Dielectric Constant ($\varepsilon_2$) |
|---|---|
| Water | 80 |
| Hydrochloric | 5 |
| Coffee Beans | 1.5 |
| Grains of mustard seed | 3.6 |
| Skimmed milk powder | 2.3 |

1) Reading 1 : Water

$r_1 = 0.1$ cm

$r_2 = 2.5$ cm

$\varepsilon_0 = 8.85 \times 10^{-12}$

$\varepsilon_1 = 1$

$\varepsilon_2 = 80$ (water)

Span = (Tank height * 0.9) - 5

= (500 * 0.9 - 5

= 445

$h_1$ = Span - liquid column height

= 445 - 45

= 400

$h_2 = 45$

$C = 2\pi \times (8.85 \times 10^{-12}) \times (1 \times 400 + 80 \times 45) / \ln(2.5 / 0.1)$

$C = 6.91$

$\therefore C = 6.91 / 100$ (cm to meter)

$\therefore C = 0.0691\ \mu F$

2. **Reading NO: 2**

Span = (Tank height * 0.9) - 5
= (500 * 0.9) - 5
= 445

$h_1$ = Span - liquid column height
= 445 - 90
= 355

$h_2$ = 90.

$C = 2\pi \varepsilon_0 (\varepsilon_1 h_1 + \varepsilon_2 h_2) / \ln(r_2/r_1)$

$C = 2\pi \times (8.85 \times 10^{-12}) \times (1 \times 355 + 80 \times 90) / \ln(2.5 \div 0.1)$

$\therefore C = 0.13\ \mu F.$

3. **Reading NO: 3**

Span = (Tank height * 0.9) - 5
= (500 * 0.9) - 5
= 445

$h_1$ = 445 - 135 = 310

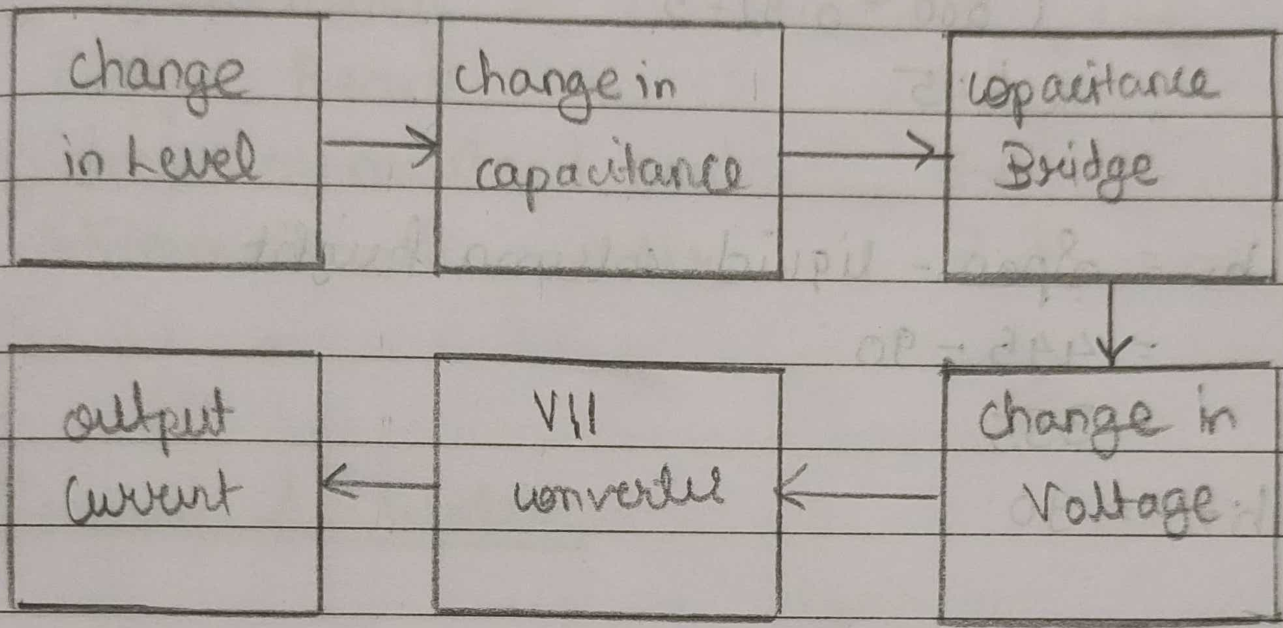
$h_2$ = 135

$C = 2\pi \times 8.85 \times 10^{-12} (1 \times 310 + 135 \times 80) / \ln(2.5/0.1)$

$C = 0.19\ \mu F.$

Date

## • Block Diagram Level to current converter:



- **Block Diagram Sensor Working:**