



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT201 – ELECTRICAL ENGINEERING & INSTRUMENTATION

II YEAR/ III SEMESTER

UNIT V – MEASURING INSTRUMENTS

WIENS BRIDGE



WIENS BRIDGE



Wein's Bridge

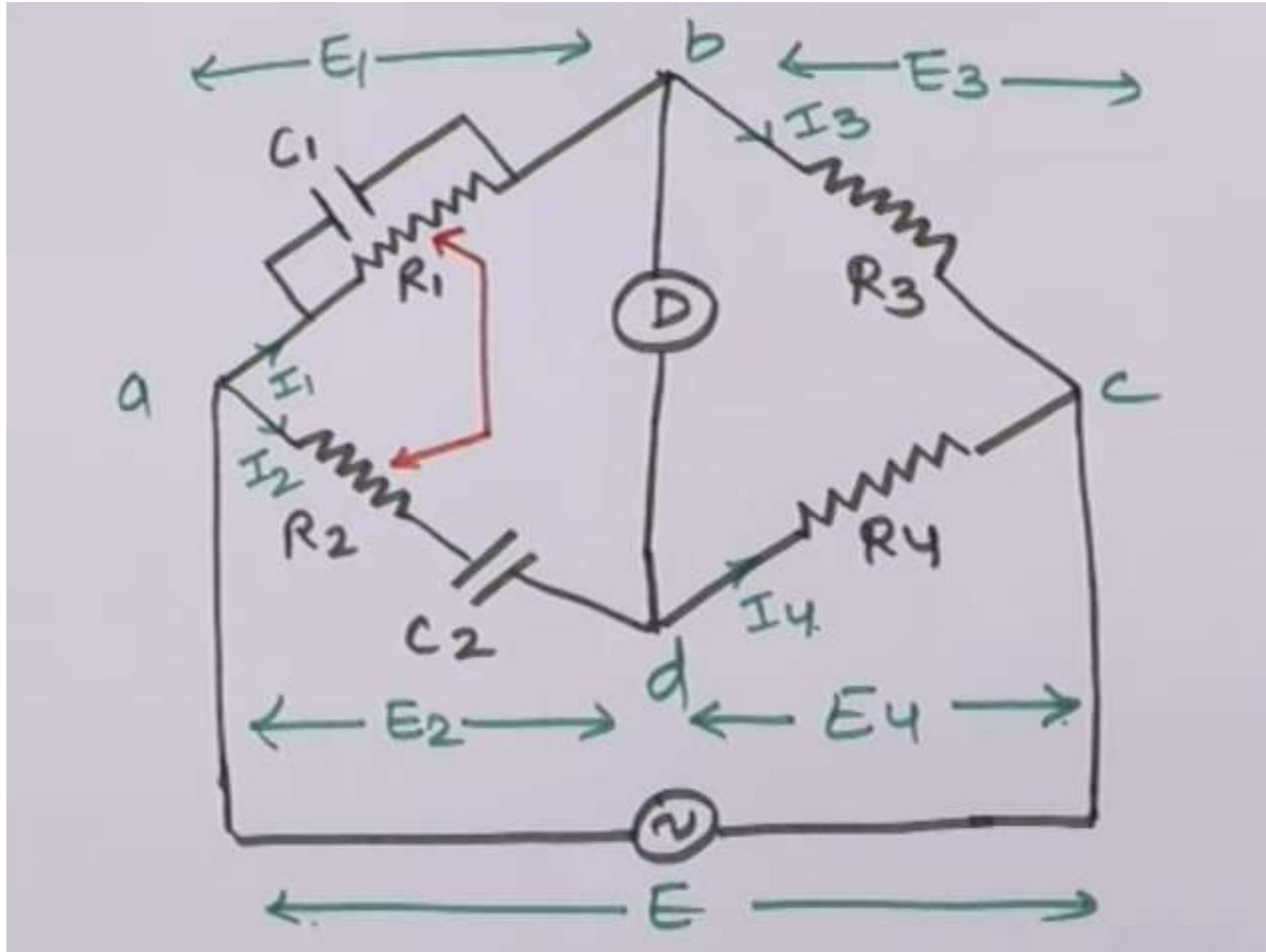
- * used for the measurement of frequency in the range from 100 Hz to 100 kHz.
- * accuracy is between 0.1% to 0.5%
- * named after the scientist Wein who invented it.

four arms $\left\{ \begin{array}{l} ab \\ bc \\ cd \\ da \end{array} \right. \begin{array}{l} Z_1 \\ Z_2 \\ Z_3 \\ Z_4 \end{array}$ impedances
Detector \downarrow null deflection

capacitor
resistor
inductor



WIENS BRIDGE



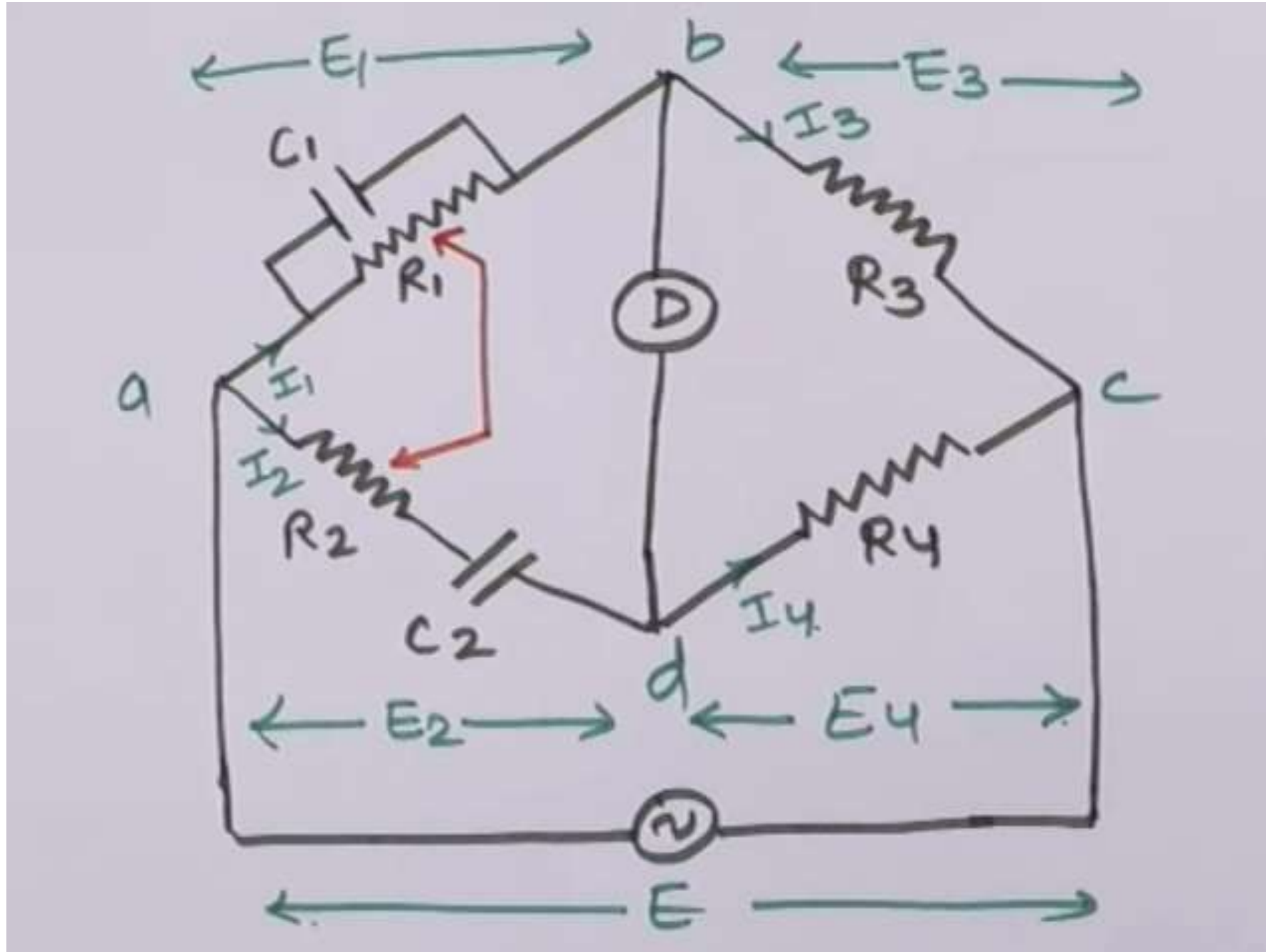
$$Z_1 = R_1 \parallel C_1$$
$$= \frac{R_1}{j\omega C_1} \parallel R_1$$
$$= \frac{R_1}{R_1 + \frac{1}{j\omega C_1}}$$

$$= \frac{R_1}{\frac{j\omega R_1 C_1 + 1}{j\omega C_1}}$$

$$Z_1 = \frac{R_1}{1 + j\omega R_1 C_1}$$



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$$Z_2 = R_2 + \frac{1}{j\omega C_2}$$

$$Z_3 = R_3$$

$$Z_4 = R_4$$



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BRIDGE BALANCE
CONDITION

$$Z_1 Z_4 = Z_2 Z_3$$

$$\frac{R_1}{1 + j\omega R_1 C_1} \times R_4 = \left[R_2 + \frac{1}{j\omega C_2} \right] \times R_3$$

$$\frac{R_4}{R_3} = \left[R_2 + \frac{1}{j\omega C_2} \right] \left[\frac{1 + j\omega R_1 C_1}{R_1} \right]$$

$$\frac{R_4}{R_3} = \left[\frac{j\omega R_2 C_2 + 1}{j\omega C_2} \right] \left[\frac{1 + j\omega R_1 C_1}{R_1} \right]$$

$$\frac{R_4}{R_3} = \left[\frac{1 + j\omega R_2 C_2}{j\omega C_2} \right] \left[\frac{1 + j\omega R_1 C_1}{R_1} \right]$$



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$$\frac{R_4}{R_3} = \frac{1 + j\omega R_2 C_2 + j\omega R_1 C_1 + j^2 \omega^2 R_1 C_1 R_2 C_2}{j\omega R_1 C_2}$$

$$\frac{R_4}{R_3} = \frac{1}{j\omega R_1 C_2} + \frac{j\omega R_2 C_2}{j\omega R_1 C_2} + \frac{j\omega R_1 C_1}{j\omega R_1 C_2} + \frac{j^2 \omega^2 R_1 C_1 R_2 C_2}{j\omega R_1 C_2}$$

$$\frac{R_4}{R_3} = \frac{1}{j\omega R_1 C_2} + \frac{R_2}{R_1} + \frac{C_1}{C_2} + j\omega C_1 R_2$$



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Equating Real Part

$$\frac{R_4}{R_3} = \frac{R_2}{R_1} + \frac{C_1}{C_2}$$

Equating imaginary Part

$$0 = \frac{1}{j\omega R_1 C_2} + j\omega C_1 R_2$$

$$0 = \frac{1 + j^2 \omega^2 R_1 C_1 R_2 C_2}{j\omega R_1 C_2}$$

$$1 + j^2 \omega^2 R_1 C_1 R_2 C_2 = 0$$

$$\omega^2 R_1 C_1 R_2 C_2 = 1$$

$$\omega^2 = \frac{1}{R_1 C_1 R_2 C_2}$$

$$\omega = \frac{1}{\sqrt{R_1 C_1 R_2 C_2}}$$

$$2\pi f = \frac{1}{\sqrt{R_1 C_1 R_2 C_2}}$$



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$$R_1 = R_2 = R$$
$$C_1 = C_2 = C$$

$$2\pi f = \frac{1}{\sqrt{R_1 C_1 R_2 C_2}}$$

$$f = \frac{1}{2\pi \sqrt{R_1 C_1 R_2 C_2}}$$

$$f = \frac{1}{2\pi RC} \quad \text{H} \delta$$



*Thank
You*