# SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

**Accredited by NBA-AICTE and Accredited by NAAC – UGC with A++ Grade**

**Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai**

## DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

**COURSE NAME: 23EET206/ Measurements and Instrumentation**

II YEAR / IV SEMESTER

UNIT 2 - COMPARATIVE METHODS OF MEASUREMENTS

Topic 4 – AC Bridges: Maxwell,

# SUCCESSFUL STUDENT

Positive Attitude

Professionally Groomed

Socially Interactive

Technically Skillful

# A.C. Bridges

- A.C. Bridges
- Maxwell's Inductance Bridge
- Maxwell-Wien Bridge
- Anderson Bridge
- Hay's Bridge
- The Owen Bridge
- Heaviside Compbell Equal Ratio Bridge
- Capacitance Bridge
- De Sauty Bridge
- Schering Bridge
- Wien Series Bridge
- Wien Parallel Bridge

# A.C. Bridges

- Resistances can be measured by direct-current Wheatstone bridge, shown in Fig. 16.1 (*a) for* which the condition of balance is that

$$\frac{R_1}{R_2} = \frac{R_4}{R_3} \text{ or } R_1R_3 = R_2R_4$$

- Inductances and capacitances can also be measured by a similar four-arm bridge, as shown in Fig. 16.1 (*b); instead of using a source of direct current, alternating current is employed and* galvanometer is replaced by a vibration galvanometer (for commercial frequencies or by telephone detector if frequencies are higher (500 to 2000 Hz)).

# A.C. Bridges

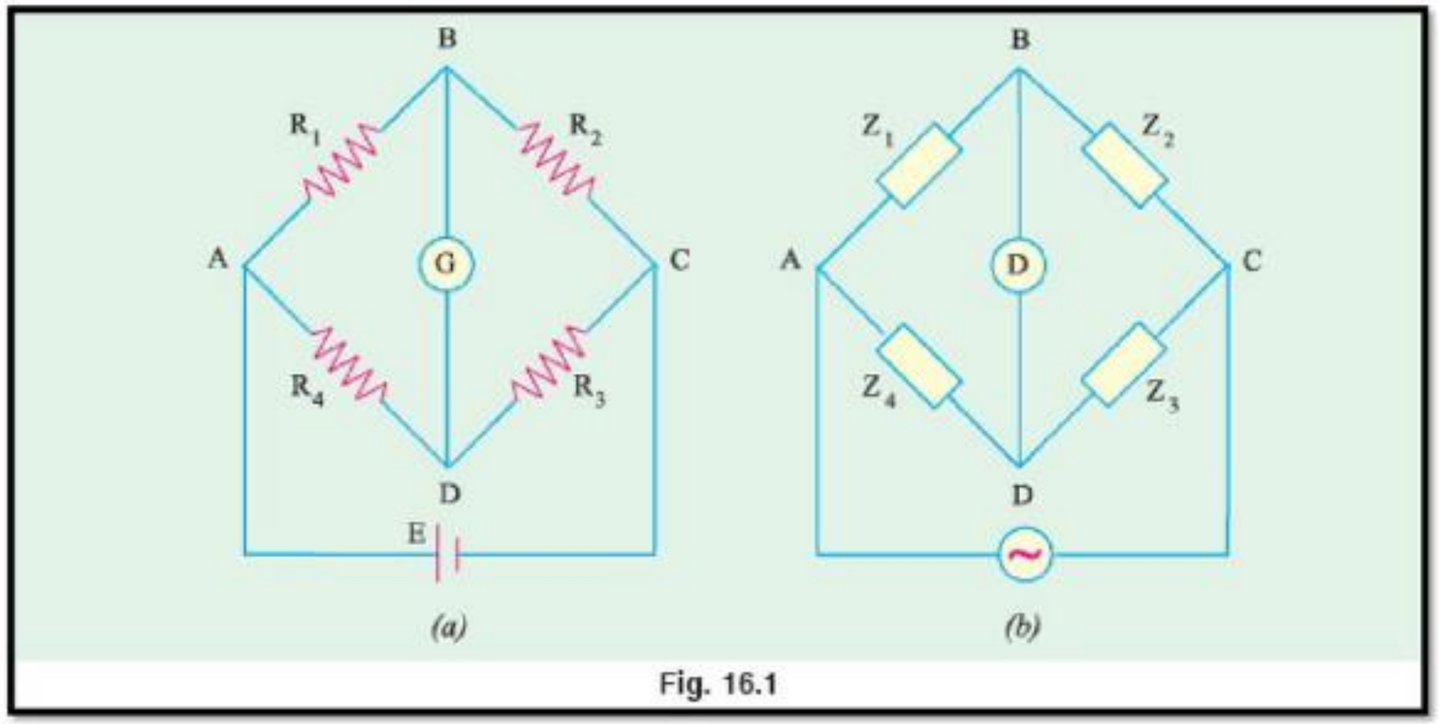
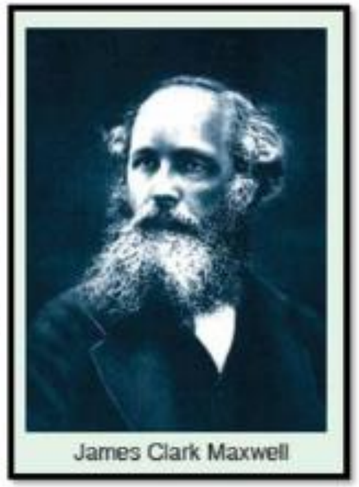
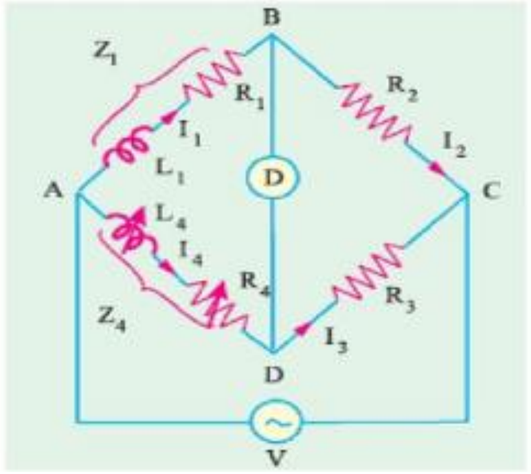



Fig. 16.1

# Maxwell's Inductance Bridge

- The bridge circuit is used for medium inductances and can be arranged to yield results of considerable precision. As shown in Fig. 16.2, in the two arms, there are two pure resistances so that for balance relations, the phase balance depends on the remaining two arms.


James Clark Maxwell



# Maxwell – Wien Bridge or Maxwell's L/C Bridge

As referred to in Art. 16.2, the *positive* phase angle of an inductive impedance may be compensated by the *negative* phase angle of a capacitive impedance put in the *opposite* arm. The unknown inductance then becomes known in terms of this capacitance.

Let us first find the combined impedance of arm 1.

$$\frac{1}{Z_1} = \frac{1}{R_1} + \frac{1}{-jX_C} = \frac{1}{R_1} + \frac{j}{X_C} = \frac{1}{R_1} + j\omega C = \frac{1 + j\omega CR_1}{R_1}$$

$$\therefore \quad Z_1 = \frac{R_1}{1 + j\omega CR_1}; \; Z_2 = R_2$$

$$Z_3 = R_3 + j\omega L_3 \text{ and } Z_4 = R_4$$

Balance condition is $Z_1 Z_3 = Z_2 Z_4$

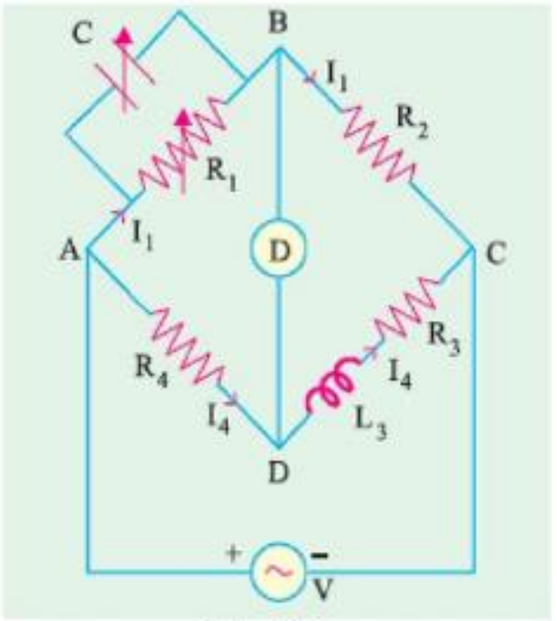


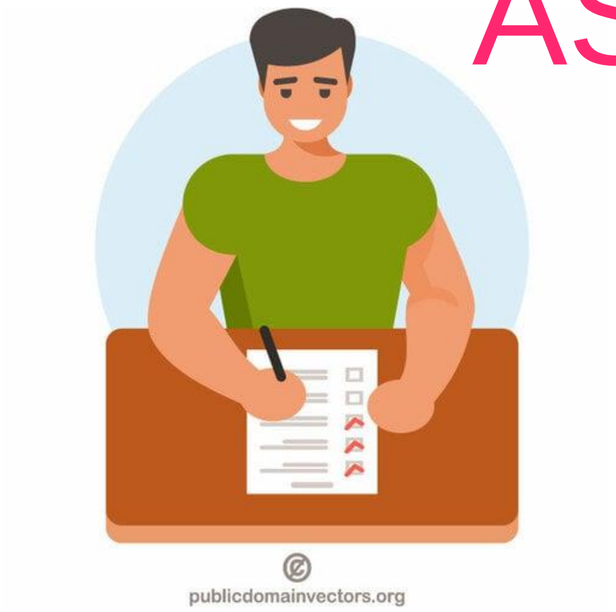

Fig. 16.5

or $$\frac{R_1(R_3 + j\omega L_3)}{1 + j\omega CR_1} = R_2R_4 \text{ or } R_1R_3 + j\omega L_3 R_1 = R_2R_4 + j\omega CR_1R_2R_4$$

Separating the real and imaginaries, we get

$$R_1R_3 = R_2R_4 \text{ and } L_3R_1 = CR_1R_2R_4; R_3 = \frac{R_2R_4}{R_1} \text{ and } L_3 = CR_2R_4$$

# ASSESSMENT




# REFERENCE


**TEXT BOOKS**

**T1** **A. K. Sawhney, “A Course in Electrical & Electronic Measurements & Instrumentation”, Dhanpat Rai & CO., New Delhi, 2022.**

**T2** **S. Gupta and J. John , "Virtual Instrumentation using Lab VIEW", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2010.**

**REFERENCES**

**R1** **David A.Bell, "Electronic Instrumentation and Measurements”, Oxford Higher Education, 2013**

**R2** **Bouwens A J, “Digital Instrumentation”, Tata Mc Graw Hill, New Delhi2016**

**R3** **Martin U. Reissland, “Electrical Measurement – Fundamental Concepts and Applications”, New Age International (P) Ltd., 2015**

**R4** **J. B. Gupta, “A Course in Electronic and Electrical Measurements and Instrumentation”, S. K. Kataria & Sons, Delhi, 2013**

**R5** **M. S. Anand, “Electronics Instruments and Instrumentation Technology”, Prentice Hall India, NewDelhi, 2012.**

**WEB REFERENCES**

**W1** **https://pasargadabzar.com/wp-content/uploads/2022/04/Morris_Langari-1.pdf**

**W2** **https://www.vssut.ac.in/lecture_notes/lecture1423813026.pdf**

**W3** **https://hombredelamancha.com/products/ebook-electrical-and-electronic-measurements-and-instrumentation?srsltid=AfmBOorTb5k9Ga1rsImj69-l3SximYYra7U8VhGcqYahqsfk9BR9rC7k**

# THANK YOU!!