

本試題是否可以使用計算機： 可使用， 不可使用（請命題老師勾選）

1. (12%) Describe and explain the four basic categories of error.
2. (a). (4%) How does an analog EVM differ from a VOM?
 (b). (3%) What type of bridge is best suited for measuring the inductance of high-Q coils?
 (c). (3%) What type of bridge is best suited for measuring the power factor of a capacitor?
3. (a). (11%) Please draw the block diagram of a **period counter** and explain it.
 (b). (5%) If the **frequency counter** outputs 6389 and time base is 5 kHz, what is the frequency of the input signal.
4. (12%) A **multirange voltmeter** is shown in Fig. 1. Assumed $V_{FSD}=10\text{ V}$, 1 V , and 100 mV and $I_{FSD}=50\text{ }\mu\text{A}$ and $R_m=300\text{ }\Omega$ for the PMMC meter, find the multiplier resistor R_1 , R_2 , R_3 .

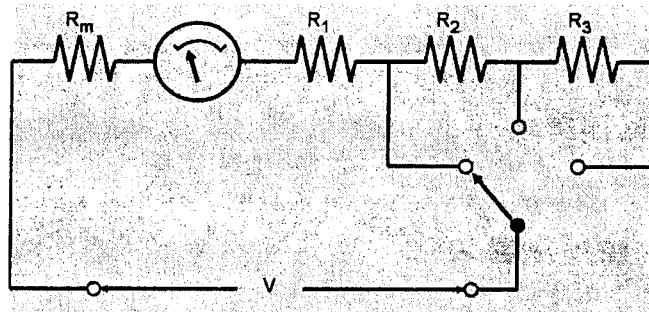


Fig. 1.

5. (10%) For the **series ohmmeter** shown in Fig. 2, determine the resistance scale markings at $R_x = 0$, $R_x = R_1$, and $R_x = \infty$. Also, determine the resistance scale markings at $1/3$ and $2/3$ of full scale.

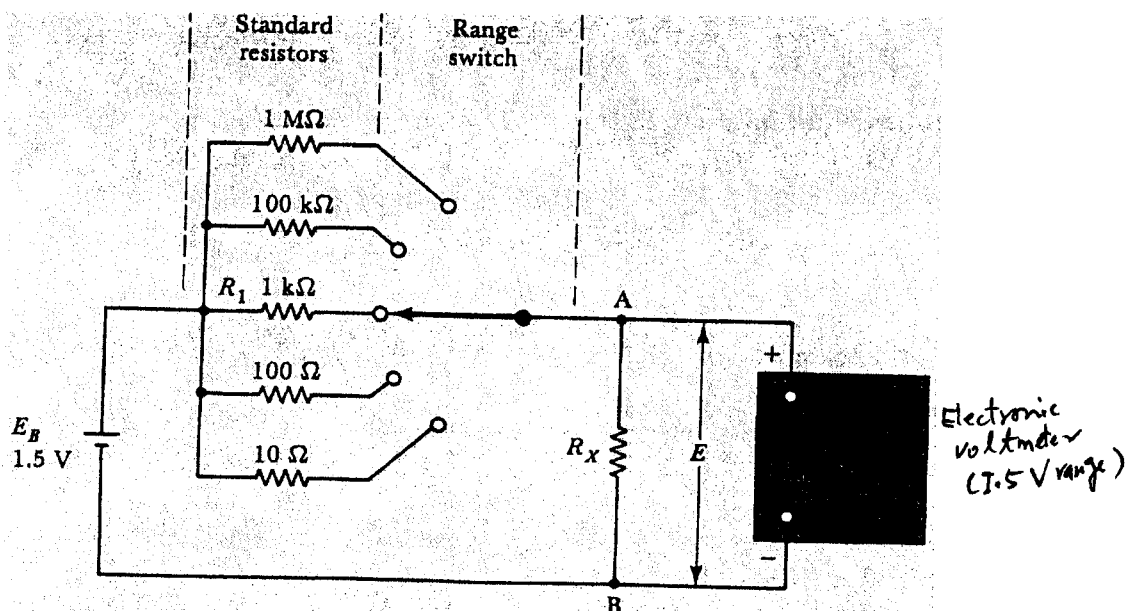


Fig. 2 A series ohmmeter for electronic instrument.

(背面仍有題目,請繼續作答)

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6. (10%) The Q-meter circuit in Fig. 3 is in resonance when $E = 200\text{mV}$, $R = 3\ \Omega$, and $X_L = X_C = 95\ \Omega$. Calculate the coil Q and the voltmeter indication.

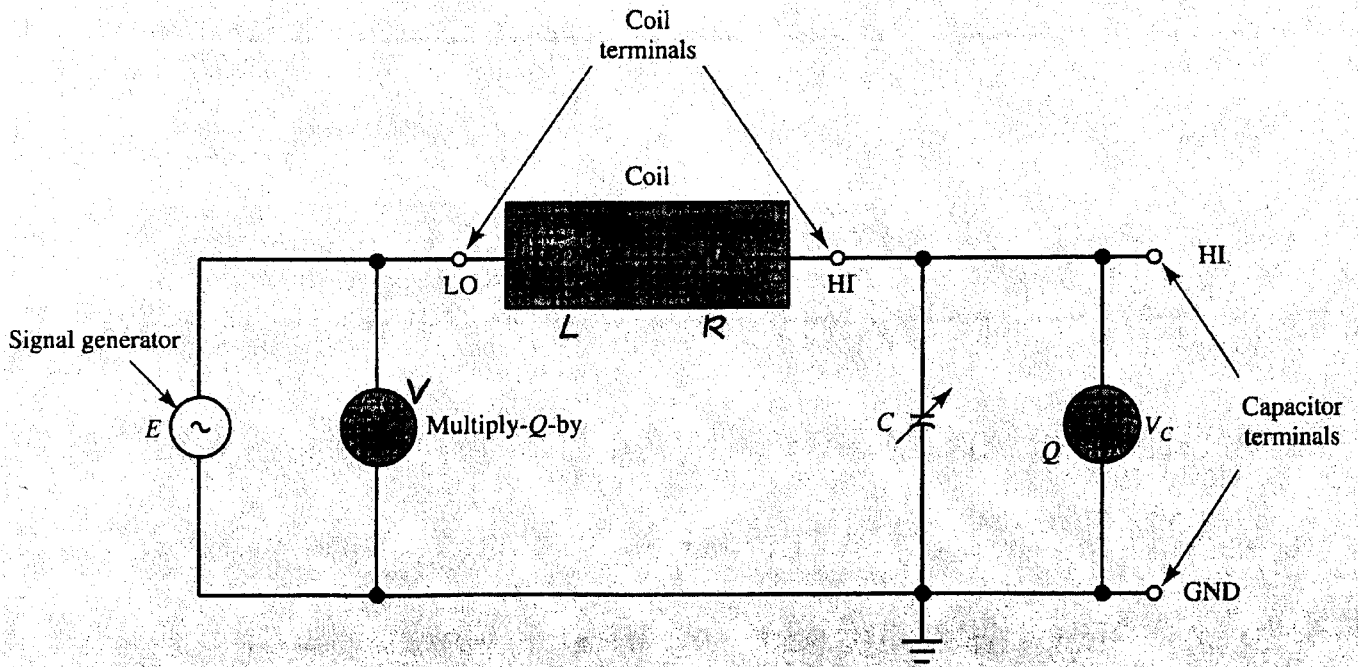


Fig. 3 A basic Q meter circuit.

7. (15%) (a) Derive the expressions of the equivalent-series inductance (L_x) and resistance (R_x) of an opposite-angle bridge (Fig. 4) at null. Find the values of L_x and R_x that causes the bridge to null with the following component values: $\omega = 3000\text{rad/s}$, $R_1 = 2\ \text{k}\Omega$, $R_2 = 10\ \text{k}\Omega$, $R_3 = 1\ \text{k}\Omega$, $C_1 = 1\ \mu\text{F}$.

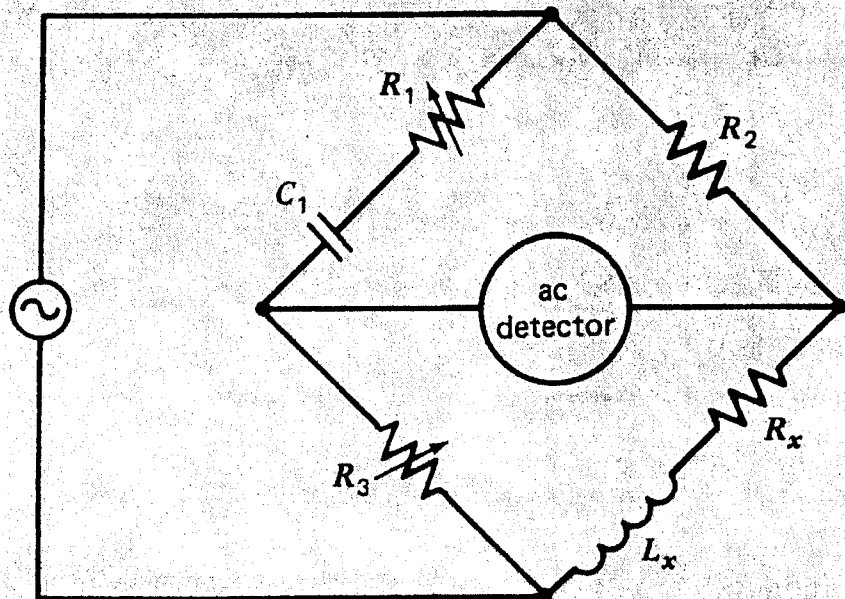


Fig. 4 Opposite-angle bridge.

8. (15%) Draw graphs to show TDR (Time Domain Reflectometry) measurement results of a (a) series R-C circuit, (b) shunt R-L circuit, and cases for a long cable terminated with (c) 50 ohms, (d) open circuit, (e) short circuit.