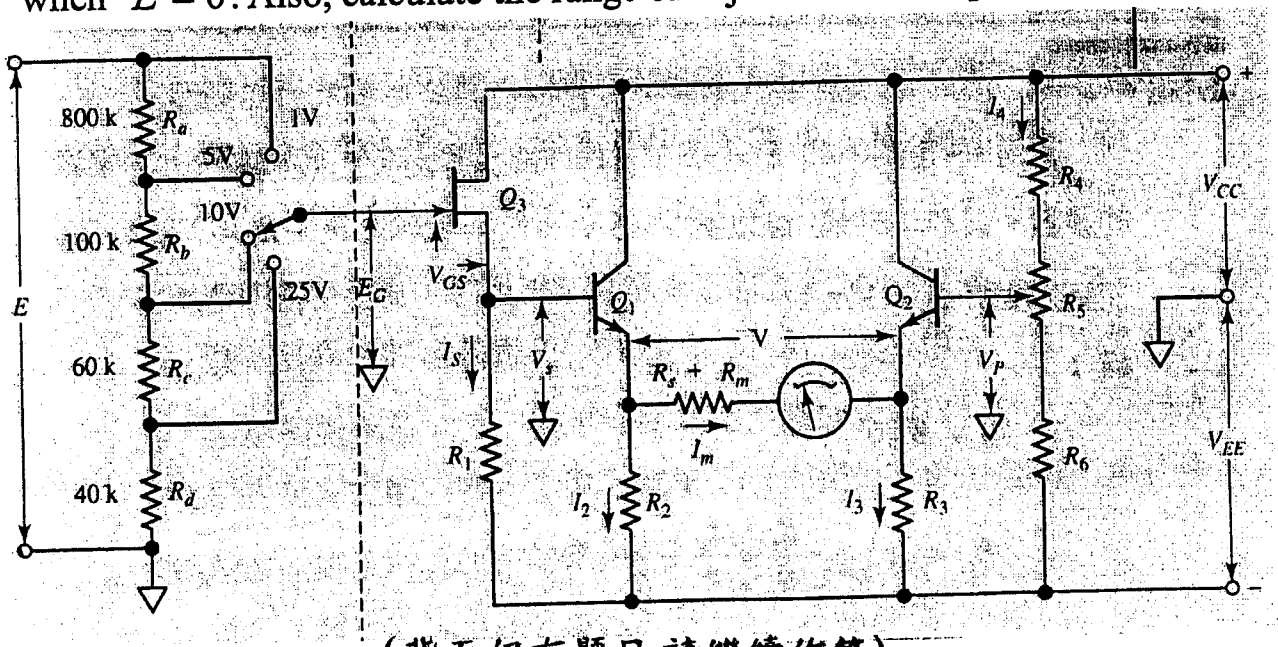
1. **(20%)** For DC analog ohmmeter, assumed the PMMC (Permanent Magnet Moving Coil) meter's accuracy to ±1% of FSD, the battery standard voltage is 10 V, the center scale is 50 kΩ (0 Ω at full scale and ∞ Ω at zero). (1) Find the resistance value with relative error as the pointer stays at 0.25 FSD (10%); (2) if the battery voltage is decreased to 8 volts, as the pointer stays at 0.25FSD find the actual resistance value and the accumulated relative error in comparison to the reading value at the ohmmeter (10%).

2. **(10%)** Draw the dual-slope A/D converter (5%) and explain why its accuracy is independent of clock and integration circuit by using the theoretical equation even the conversion rate is so slow (5%).

3. **(10%)** (1) Find the criteria to create an oscillation signal, (2) explain the leakage error when using DDS (direct digital synthesis) techniques in the digital signal generator to create the arbitrary waveform.

4. **(10%)** (1) Use a transistor and a Zener diode to create a voltage regulator and find the output voltage, (2) Use a transistor, a Zener diode, and an operational amplifier to create a voltage regulator and the output voltage is adjustable by resistors.

5. **(15%)** The FET input voltmeter circuit shown below has the following components: $R_1 = 6.8\,k\Omega$, $R_2 = R_3 = 4.7\,k\Omega$, $R_4 = 1.5\,k\Omega$, $R_5 = 500\,\Omega$, $R_6 = 3.3\,k\Omega$, $R_s + R_m = 20\,k\Omega$. The meter full-scale current is $50\,\mu A$, the supply voltage is ± 10 V, the transistors have $h_{FE} = 80$, and the FET gate-source voltage is $V_{GS} = -3$ V. Determine V_P, I_S, I_2, I_3, and I_4 when $E = 0$. Also, calculate the range of adjustment for V_P.



(背面仍有題目，請繼續作答)

6. **(20%)** (1) Explain the terminologies: LCR meter, Impedance Analyzer, Time Domain Reflectometry (TDR). (12%) (2) Explain the patterns on the TDR that shown below (8%):

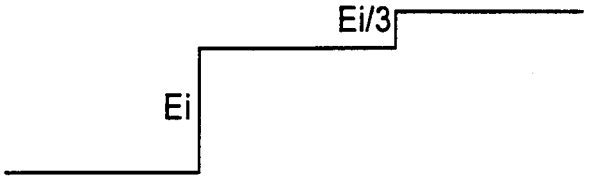


Fig. 6(a)

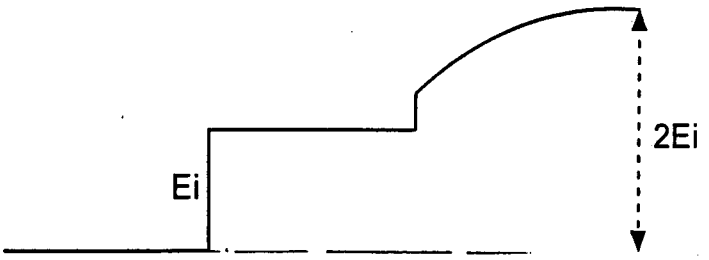


Fig. 6(b)

7. **(15%)** A parallel-resistance capacitance bridge uses a 0.1 μF capacitor for C_1, and the supply frequency is 1 kHz. At balance, R_1=547 Ω, R_3=1 kΩ, and R_4=666 Ω. Determine the parallel RC components of the measured capacitor, and calculate the capacitor dissipation factor.

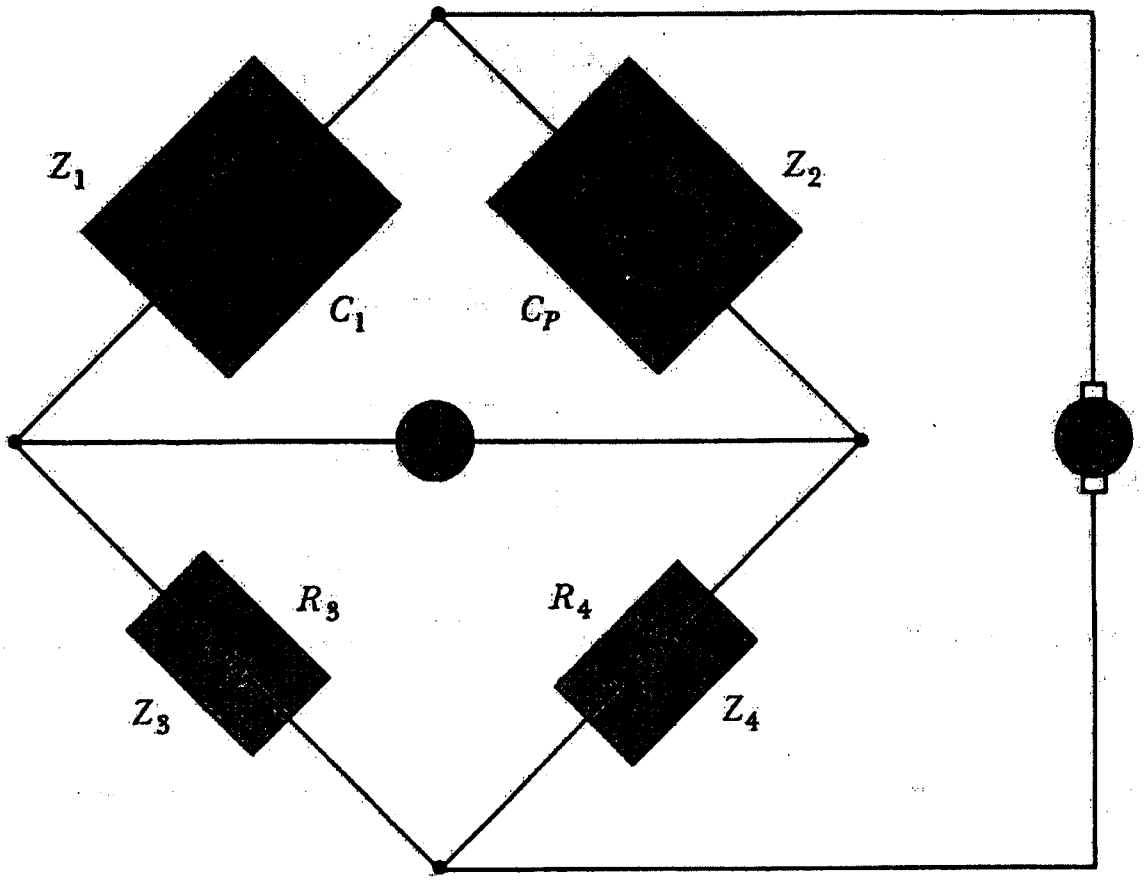


Fig. 7. A parallel-resistance capacitance bridge.