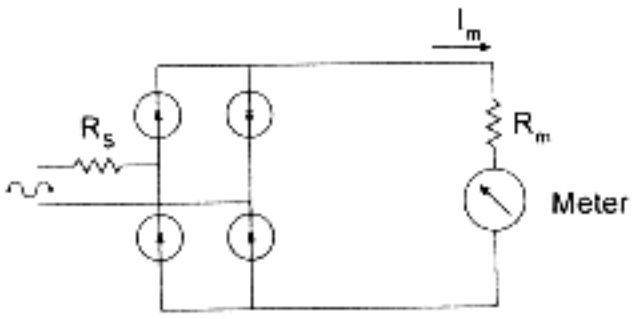
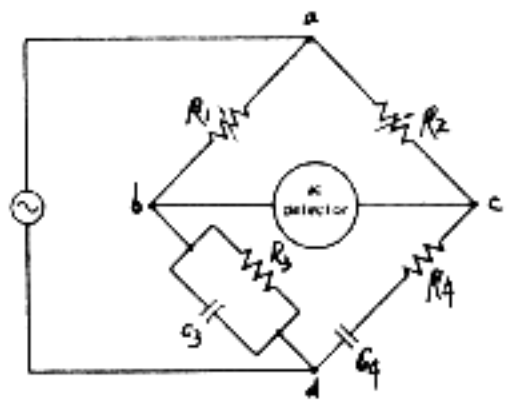
1. **(20%)** (a) An ac voltmeter uses a bridge rectifier with silicon diodes and a PMMC instrument with FSD=75 μA. If the meter coil resistance is 900 Ω and the multiplier resistor is 708 kΩ. calculate the applied rms voltage when the voltmeter indicates FSD. (b) Determine the new multiplier resistance required for the voltmeter to change its range to 300 V FSD. (c) Determine the pointer position on the voltmeter in problem (b) when the applied rms voltage is (i) 30 V and (ii) 15 V.



AC voltmeter



Bridge

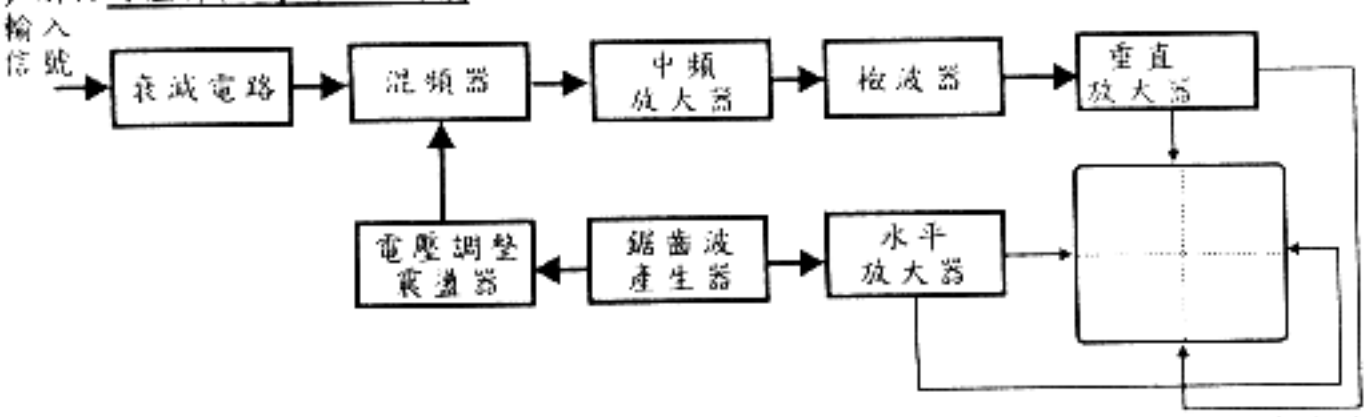
2. **(15%)** Derive the expressions of the equivalent-parallel capacitance (C_3) and resistance (R_3) of the bridge at null (shown above). Find the values of C_3 and R_3 that causes the bridge to null with the following component values: $f = 2.5$ kHz, $R_1 = 100$ kΩ, $R_2 = 25$ kΩ, $R_4 = 3.1$ kΩ, $C_4 = 5.2$ μF

3. **(20%)** There are two loops (Murray and Varley loops) used to measure the distance where short circuit happens by applying the theory of the Wheatstone bridge. Describe how both loops function, and which loop has more accuracy and why?

4. **(10%)** Prove the error percentage of quotient is equal to the summation of dividend's and divisor's error percentages.

5. **(10%)** Describe the major characteristics of Similar Angle Bridge.
(10%) Give two bridges that satisfy the major characteristics of Similar Angle Bridge.

6. **(10%)** 解釋外差掃描式頻譜分析儀之工作原理及特性。



(5%) 若以頻譜分析儀測量一有諧波失真(harmonic distortion)之正弦波(sine wave)，請畫出其在螢幕上顯示之圖樣。