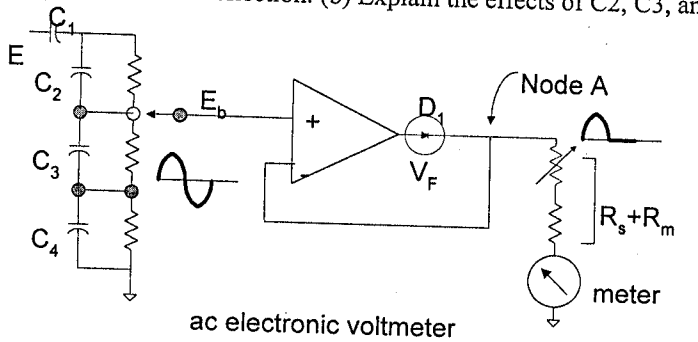
1. **(20%)** The half-wave rectifier electronic voltmeter in the figure shown below uses a 0.5 mA deflection meter with a 460 Ω coil resistance. (a) If $R_s = 450\ \Omega$, calculate the rms input voltage (i.e. Eb) required to give half-scale deflection. (b) Explain the effects of C2, C3, and C4. How if we place D1 after node A?



ac electronic voltmeter

2. **(15%)** Using a 4.5 V battery together with a PMMC meter that has 100 μA FSD and a coil resistance of 100 Ω, design a series ohmmeter to have a range of 1 kΩ to 100 kΩ.
3. **(15%)** Briefly explain the following terms: (1) Instrumentation Amplifier (2) Lock-in Amplifier (3) Chopper Amplifier (4) Isolation Amplifier (5) Linear Variable Differential Transformer (LVDT).
4. **(15%)** The parameters in a Wheatstone Bridge are: P=4KΩ, Q=1KΩ, S=2KΩ, E=10V, minimum adjustable $\Delta S = \pm 0.2\ \Omega$, R_m=1KΩ, and I_G(min)=0.5 μA. Find the value of R when balance (5%) and the resolution of the Wheatstone bridge (10%).
5. **(15%)** To measure the inductance of an inductor, there are two bridges: Maxwell and Hay bridges. Describe these two bridges (10%) and find their differences (5%).
6. **(10%)** A low-capacitance probe contains a parallel RC circuit. Explain why it can expand the measurable frequency range. Assume a measured source E with R_s (source resistance)=600Ω, R=9MΩ and C=13pF for the low-capacitance probe, R_{in}(input resistance of an oscilloscope)=1 MΩ, C_t (total capacitance shunt with R_{in})=120 pF.
7. **(10%)** In IEEE-488 interface, describe the role of controller, listener, and talker.

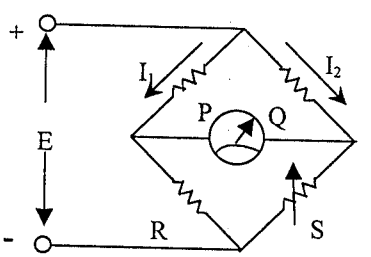


Figure for Problem 4