

※ 考生請注意：本試題可使用計算機

1. (a). Describe three general categories of measurement. (9%)
 (b). Describe and compare geometric mean and harmonic mean. (6%)
 (c). Describe last digit bobble. (5%)
2. Resolve signals that differ by 40 dB for a spectrum analyzer (Bandwidth Selectivity is 11:1. The filter skirt is assumed to be straight between 3-dB and 60-dB points for simplicity).
 (a) Derive the formula: $-3 \text{ dB} - [(\text{Offset} - \text{BW}_{3\text{dB}}/2) / (\text{BW}_{60\text{dB}}/2 - \text{BW}_{3\text{dB}}/2)] \times \text{Diff}_{60,3\text{dB}}$. (7%)
 (b) If the filter is given 4 kHz bandwidth, please find the maximum frequency difference of signals that can be resolved by this filter. (8%)
3. An ohmmeter circuit is shown below (Fig. 1). Assume $E_b = 2 \text{ V}$, $R_1 = 20 \text{ k}\Omega$, $R_2 = R_m = 15 \Omega$.
 (a) If the ohmmeter is in the reading of 0.5 FSD, find R_x . (7%)
 (b) From (a), if E_b changes to 1.6 V, how to make the reading of the ohmmeter remain 0.5 FSD? (8%)

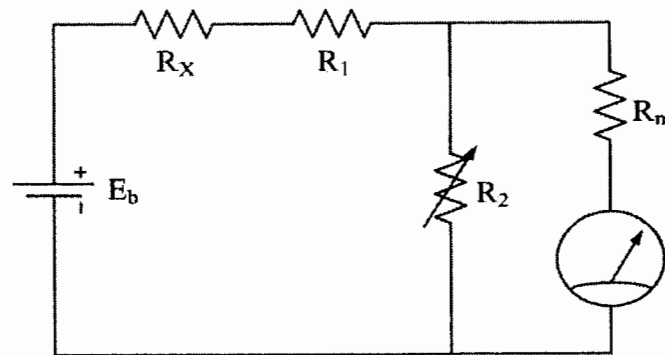


Fig. 1

4. Sketch circuit diagrams to show how a voltmeter (伏特計) and ammeter (安培計) should be connected to measure (a) a very high resistance (10%) and (b) a very low resistance (10%). Explain briefly.
5. Draw a circuit and waveforms to show how capacitance (電容) can be measured using a bridge. Explain. (10%)
6. Describe the theory of operation of the following impedance measurement techniques: (a) Auto balancing bridge, (b) Resonant, (c) I-V method, (d) TDR. What are the advantages and disadvantages of each technique? (20%)