請依題號順序作答:

1.(a) How to determine the contact potential and ideal factor of an abrupt p-n junction ? (5%)
(b) What are the advantages of poly-silicon gate MOS process ? (5%)
(c) What is the real meaning of "TTL compatible" ? Why does the ECL family have the lowest propagation delay ? (5%)

2.(a) Explain how to measure time by means of a counter. (5%)
(b) Sketch the block diagram of a PLA. How is PLA related to a ROM ? (5%)
(c) Draw the circuit of a Wilson current source and list two advantages. (5%)
(d) Describe the LARAM organization of a CCD memory. (5%)

3. For the practical integrator shown in Fig. 1,
(a) verify that the bias current through C is the input offset current I_{io}, (5%)
(b) if the initial energy of C is zero, find $v_o(t)$. (5%)

4. (a) Explain why a switching regulator is capable of very high conversion efficiency. (3%)
(b) Verify that, if the switching frequency (f_s) is much greater than the frequency of signal, a switched capacitor is equivalent to a resistance. (3%)
(c) In a Schmitt trigger, what will happen if the system loop gain is less than 1 ? why ? (3%)
(d) From both dc and ac point of views, state the basic requirements of a level-shift network.(3%)
(e) Explain how to use Bode plot and Nyquist diagram to test the stability of a feedback system . (3%)

5. (a) Find the transfer function of the active-RC filter shown in Fig. 2 . (5%)
(b) Sketch its frequency-response characteristics and determine what type of this filter is. (5%)

6.(a) If the common-emitter BJT (see Fig. 3) is operated under high frequency condition, draw the unilateral hybrid-π equivalent circuit by use of Miller's theorem. Assume the current in $C\mu$ is negligibly small. (5%)
(b) If the denominator of $A_{VH}(s)$ ($= V_o(s)/V_i(s)$) is expressed as ($1 + a_1S + a_2S^2$), use the time-constant method to calculate a_1 .(5%)

7. Assume the Op-Amp shown in Fig. 4 has infinite input impedance and zero output impedance, (a) determine the return ratio T(s), (b) find the pole frequency ω_o and the pole Q factor. (5%+5%)

8. (a) Describe briefly the operation of the circuit shown in Fig. 5 . (5%)
(b) Assume a 5 V Zener diode, a current gain from base to emitter of 70, and a load current of 210 mA. Calculate a value for R that will set the Zener current to one third of the base current of the transistor. (5%)

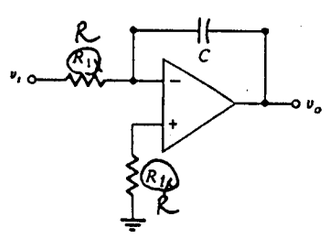

Fig. 1

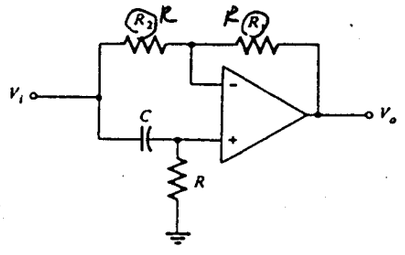

Fig. 2

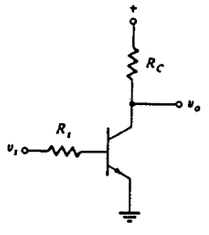

Fig. 3

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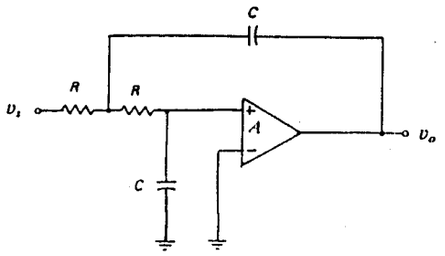

Fig. 4

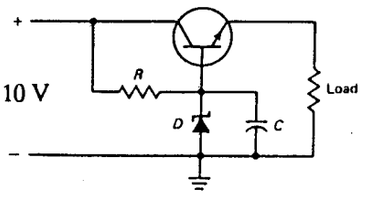

Fig. 5