Final Exam Electronics(3) NCKUEE 01/10/2012

(20%) 1. Consider an Nth-order Butterworth low-pass filter $T(j\omega)$ whose passband edge $\boldsymbol{\omega_p}$ **= 1MHz**, stopband edge $\boldsymbol{\omega_s}$ **= 10MHz**, maximum allowed variation in passband is A_{max}, minimun required stopband attenuation is A_{min}, and its magnitude function $|T(j\omega)| = \dfrac{1}{\sqrt{1+\varepsilon^2(\frac{\omega}{\omega_p})^{2N}}}$.

(a) For a filter with **ε = 1, N = 3,** please find its $\mathbf{A_{max}}$ **and** $\mathbf{A_{min}}$. (10%)

(b) For a filter with A_{max} = 1dB and A_{min} = 30dB, please find the **required filter order**. (10%)

(20%) 2. Fig. P2 shows pole-zero patterns for two different filters, and both filters have double zeros at the origin. The distance from the origin to each pole is ω_0 for both filters, while $\theta_1 > \theta_2$.

(a) For **Fig. P2(a),** please specify **which type** of filters it is. (Hint: low-pass / high-pass / band-pass / all-pass). **Explain your reason**. (10%)

(b) Compare both filters in Fig. P2 by roughly **drawing their Bode magnitude plots**. **Explain your reason**. (10%)

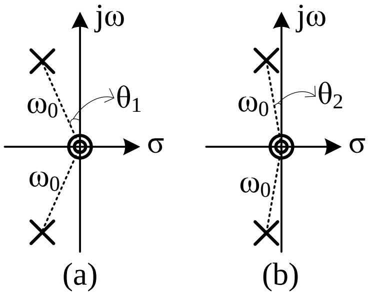


Fig. P2

(15%) 3. Fig. P3 shows a switched-capacitor integrator, and the period of the two-phase clock is T_c.

(a) Without considering the C_P, express the **equivalent time constant** of the integrator in terms of $\mathbf{C_1}$, $\mathbf{C_2}$, and $\mathbf{T_c}$. (5%)

(b) Compared with an active-RC integrator, what are the **benefits** of a switched-capacitor integrator for on-chip implementation? (5%)

(c) Will the stray capacitance $\mathbf{C_P}$ affect the time constant of this circuit or not? **Explain your reason**. (5%)

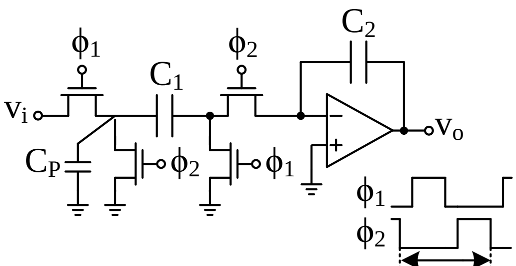


Fig. P3

(10%) 4. Please give definitions of the following terms.

(a) Stagger-tuned amplifier (5%)

(b) Astable multivibrator (5%)

（背面尚有試題，請繼續作答！）

(15%) 5. (a) Please describe the Barkhausen criterion. (10%)

(b) In Fig. P5, will the circuit start oscillation or not? **Explain your reason**. (5%)

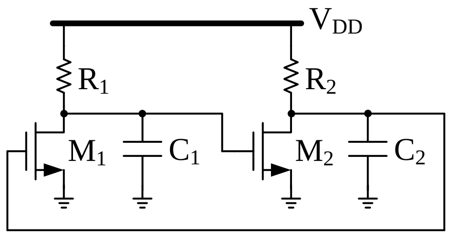


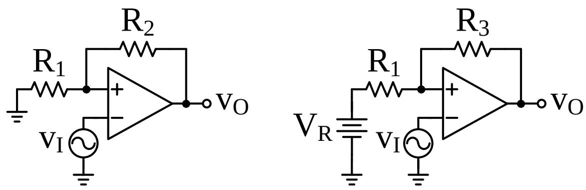
Fig. P5

(20%) 6. Fig. P6 shows two inverting bistable circuits, and the output saturation vlotages $L_+ = -L_- = 12V$.

(a) For Fig. P6(a), assume that the threshold voltages $V_{TH} = -V_{TL} = 4V$. Please **sketch its transfer characteristic curve** (mark the L_+, L_-, V_{TH}, V_{TL}, and the direction of the transfer operation on your plot). (5%)

(b) Assume that $R_1 = 1k\Omega$, please **find R_2**. (5%)

(c) If a DC voltage source **$V_R = 3V$** is inserted, as shown in Fig. P6(b), and **$R_1 = 1k\Omega$, $R_3 = 2k\Omega$**. Please **sketch its transfer characteristic curve** (mark the L_+, L_-, V_{TH}, V_{TL}, and the direction of the transfer operation on your plot). (10%)



(a) (b)

Fig. P6