系級班別：_____ 學號：_____ 姓名：_____

(不可攜帶資料，可用計算機) 請在答案卷右上方畫上成績欄，謝謝。

(10%) 1. Derive the normalized polynomial of a 2nd-order Butterworth filter with ε = 1.

$$\left(\text{Butterworth transmission function}=\frac{1}{\sqrt{1+\varepsilon^2\left(\frac{\omega}{\omega_p}\right)^{2N}}}\right)$$

(10%) 2. Find the Butterworth transfer function that meets the following low-pass filter specification: f_p=10-kHz, f_s=15-KHz, $A_{\min}$=10dB, dc gain=1 and ε=1.

(20%) 3. Your answers should be as simple as possible.

(a) Plot the rough transmission characteristics of Fig. 3. (10%)

(b) Determine the order (5%)

(c) Show its approximate transfer function. (5%)

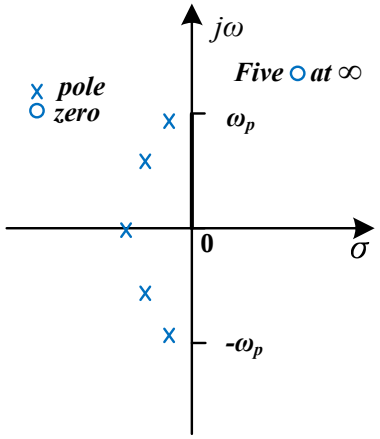

Fig. 3

(20%) 4. (a) Derive a block diagram of a two-integrator-loop biquad. (10%)

(b) Circuit implementation of (a) with KHN biquad. (10%)

(10%) 5. For a Antoniou inductance-simulation circuit.

(a) Briefly explain its purpose. (5%)

(b) Show its application for a 2nd-order LPF. (5%)

(20%) 6. For a dc voltage of 1V applied to the input of the circuit of Fig. 6, in which C_1 is 1pF.

(a) What charge is transferred for each cycle of the two-phase clock? (3%)

(b) For a 100-kHz clock, what is the average current drawn from the input source. (4%)

(c) For a feedback capacitance C_2 of 10pF, what change in the output for each cycle of the clock? (3%)

(d) Why is the time constant of the circuit in Fig. 6 accurate? (10%)

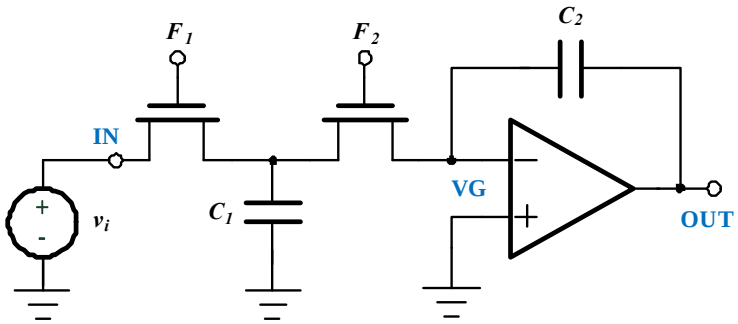

Fig. 6

(10%) 7. It is required to design a tuned amplifier of the type shown in Fig. 7, having f_0=1MHz, 3-dB bandwidth = 10-kHz, and center-frequency gain=-10V/V. The FET available has at the bias point gm=5mA/V and r_o=10kΩ. The output capacitance is negligibly small. Determine the values of R_L, C_L, and L .

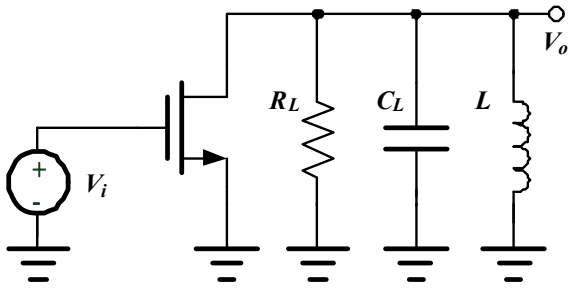

Fig. 7

(10%) 8. For the circuit in Fig. 8, find its oscillation frequency.

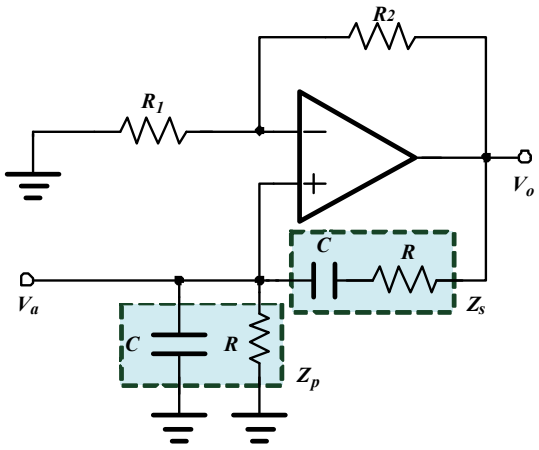

Fig. 8