

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

- (15%) Figure 1 shows a type of logic gate. Assume the diodes are ideal. The voltage  $V_A$  and  $V_B$  independently have values of either 0 V or 5 V (for logic 0 or logic 1). Show the truth table of this logic gate (12%). What type of logic gate is it? (3%)
- (15%) The transistor of Fig. 2 has  $KP=75\mu A/V^2$ ,  $V_{to}=0.9$  V,  $L=25\mu m$ ,  $W=400\mu m$ . Determine the value of  $R_1$  (8%) and  $R_s$  (7%).
- (20%) Assume the op amps in Fig. 3 are ideal. (a) Derive an expression for the voltage gain  $A = v_o/v_s$ . (10%) (b) If  $v_s(t) = 3 \sin(\omega t)$ , sketch  $v_1(t)$ ,  $v_2(t)$ , and  $v_o(t)$  to scale versus time. (10%)
- (30%) Consider the circuit in Fig. 4. (a) Draw the small-signal equivalent circuit for the frequency of  $v(t)$  is in the midband range (10%). (b) Assume that  $r_d = \infty$ , derive expressions for the voltage gain (5%), input resistance (5%), and output resistance (5%). Is this amplifier inverting or noninverting? (5%)
- (20%) Consider the circuit shown in Fig. 5. Derive an expression for the voltage transfer ratio  $A(f)$  (10%). Sketch the magnitude Bode plot to scale (10%).

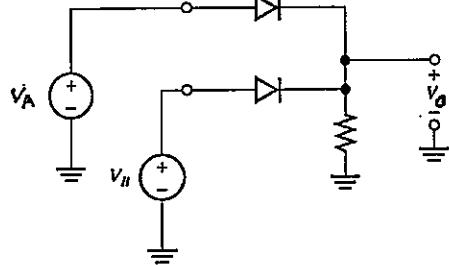


Fig. 1

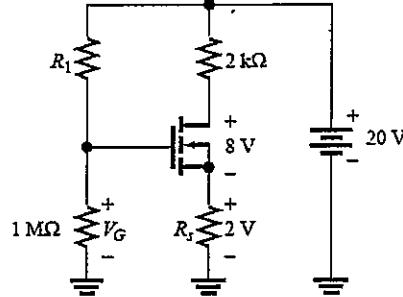


Fig. 2

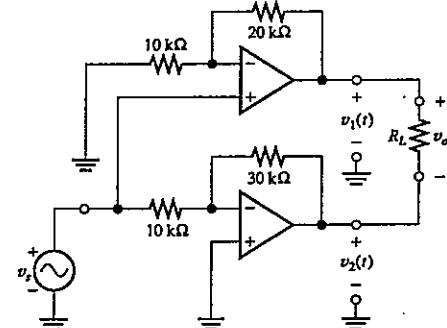


Fig. 3

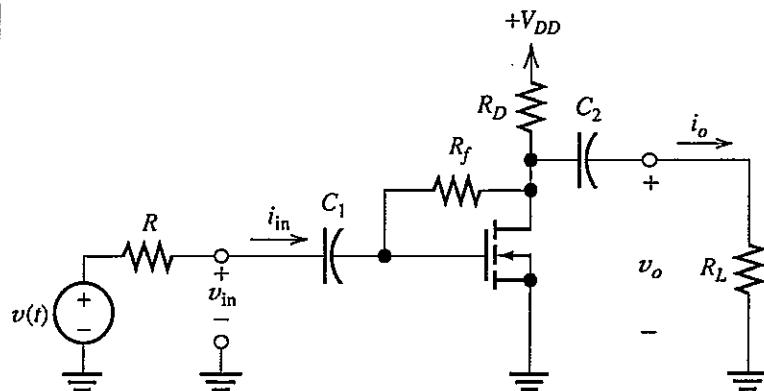


Fig. 4

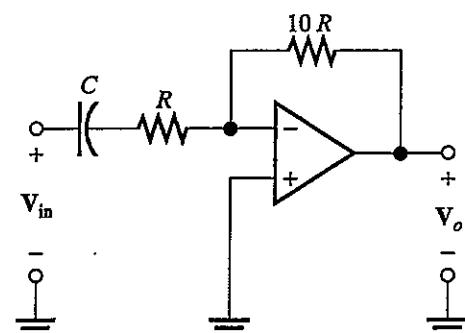


Fig. 5