所別：光電科學研究所碩士班 科目：電子學

(15%) 1. Referring to Fig. 1, find the transfer characteristics (V_o *vs.* V_i) for the circuit, where V_o^+ and V_o^- are the saturation output voltage levels of the amplifier.

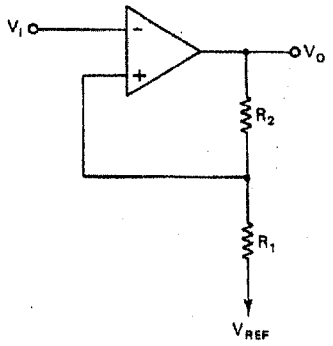

Fig. 1: Question 1

(20%) 2. Consider the operation of the circuit shown in Fig. 2 for V_B at $-1V$, $0V$, $+1V$. Assume that V_{BE} is $0.7V$ for usual currents and that β is very high.

(a) What values of V_E and V_C result?

(b) At what value of V_B does the emiter current reduce to one-tenth of its value for $V_B = 0V$?

(c) For what value of V_B is the transistor just at the edge of conduction? What values of V_E and V_C correspond?

(d) For what value of V_B does the transistor reach saturation (when the base-to-collector junction reaches $0.5V$ for forward bias)? What values of V_C and V_E correspond ?

(e) Find the value of V_B for which the transistor operates in saturation with a forced β of 2?

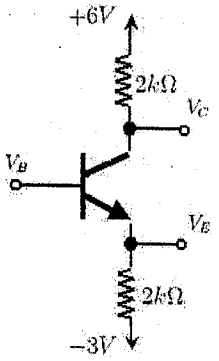

Fig. 2: Problem 2

(15%) 3. In Fig. 3, assume the diodes D_1 and D_2 have the same threshold voltage V_T, the forward-biased resistance R_f, and the reverse-biased resistance R_r and $R >> R_f + R_s$. Analyze the operation of the output voltage $V_o(t)$ under the below input condition. ($V_T = 0.5V$, $V_{CC} = 10.0V$)

- $t = 0.0 \sim 5.0$sec, $V_1 = 0V$, and $V_2 = 0V$
- $t = 5.0 \sim 10.0$sec, $V_1 = V_{CC}$, and $V_2 = 0V$
- $t = 10.0 \sim 15.0$sec, $V_1 = 0V$, and $V_2 = V_{CC}$
- $t = 15.0 \sim 20.0$sec, $V_1 = V_{CC}$, and $V_2 = V_{CC}$

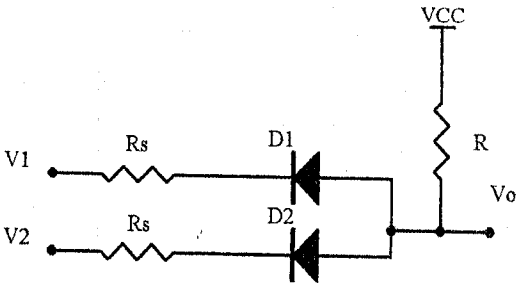

Fig. 3: Problem 3

注：背面有試題

(15%) 4. (a) Draw the JK Flip-Flop symbol and describe the true-false table. (5%)
(b) If we have a oscillator with 80 MHz frequency, please design a divider circuit to get the 20 MHz and 2.5 MHz using J-K Flip-Flops. (10%)

(15%) 5. The following logic function Y=A•B+A⊕B.
(a) if A=true, B=false, what's Y logic? (2%)
(b) draw the logic gate circuit. (3%)
(c) realize the function using npn transistor device. (10%)

(20%) 6..Please use the operation amplifiers, resistors and capacitors to construct the analog computer for the differential equation?

$$2\frac{dx}{dt} + 10x = -5f(x)$$