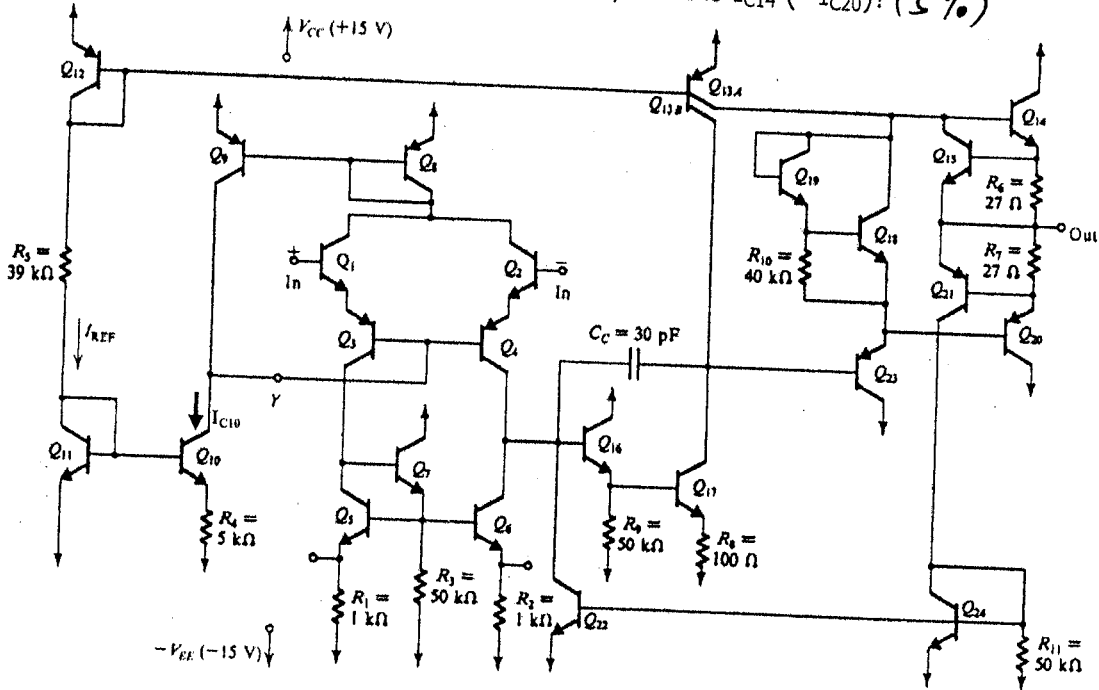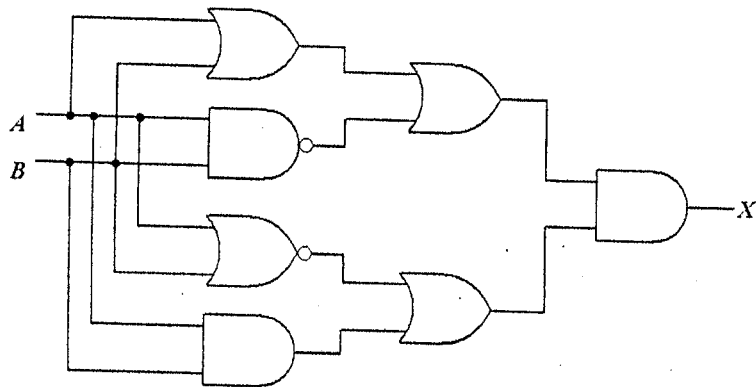所別：<u>光電科學研究所碩士班 一般生</u> 科目：<u>電子學</u>
<u>學位在職生</u>

15 %　1.　Refer to the circuit below, calculate the values of

(a)　I_{REF}　**(5%)**

(b)　I_{C10} (I_C of Q_{10})　**(5%)**

(c)　If $I_{C13A} = 0.25\ I_{REF}$ and $V_{out} = 0.0$, what is I_{C14} ($= I_{C20}$)?　**(5%)**

15 %　2. Simplify the logic circuit with as few logic gates as possible (AND, OR, and NOT gates only). A and B are two input ports, and X is the output port.
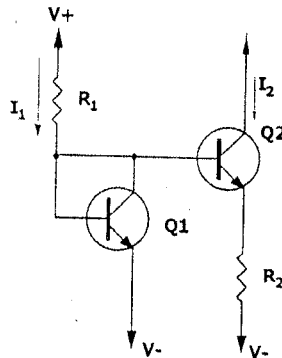

15 %　3. Draw the circuit symbol and label the node's name : (a) Zener diode, (b) pnp BJT, (c) enhancement n-channel MOSFET, (d) depletion p-channel MOSFET, (e) p-channel JFET. (3x5=15)
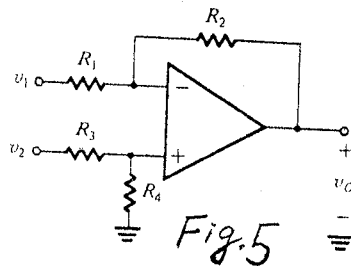
15% 4. Derive the relation between I_1 and I_2 in the circuit below.

20 % 5. Consider the difference amplifier of Fig.5 with the two input terminals connected together to an input common-mode single source. For $R_2/R_1 = R_4/R_3$, show that the input common-mode resistance is $(R_3 + R_4) \| (R_1 + R_2)$

Fig.5

20% 6. Show that if all transistors are operated at an effective voltage V_{eff} and have equal Early voltage $|V_A|$, the gain is given by

$$A_d = 2(V_A/V_{eff})^2 \quad (10\%)$$

Evaluate the gain for $V_{eff} = 0.25$ V and $V_A = 20$V. (10%)