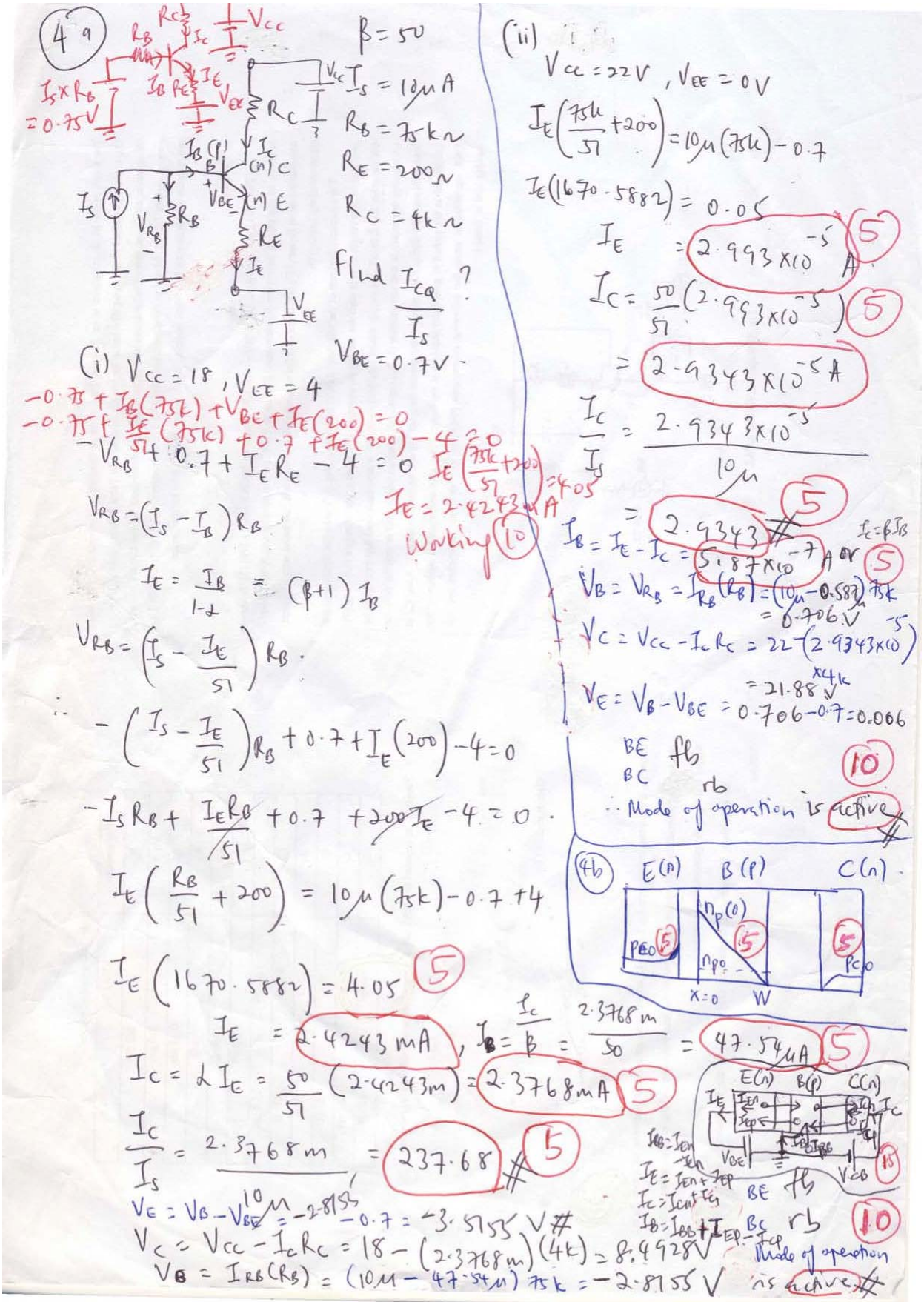
ANSWER TO TEST 2

QUESTION 1



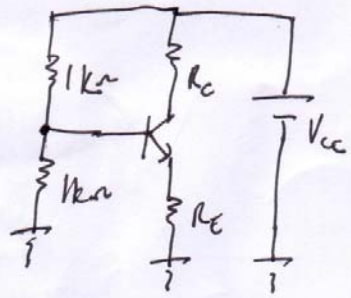
QUESTION 2

(3)

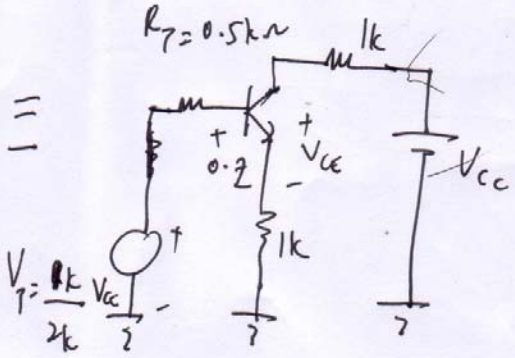
$\alpha = 0.98 \quad I_{CBO} = 0 \quad V_{BE} = 0.7\,V$

I_B? I_C? V_{CE}?

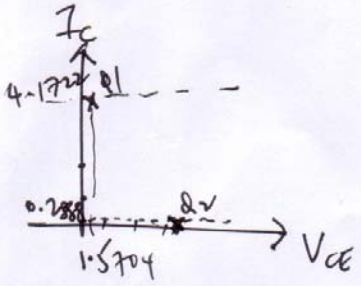
$R_1 = R_2 = R_C = R_E = 1k\Omega$.



$\equiv$



$= 0.5V_{CC}$



$I_C = \beta I_B$

$I_E = \alpha I_B$

$\beta I_B = \alpha I_E$

$I_E = \frac{\beta}{\alpha} I_B$

$= \frac{\beta}{(1-\alpha)\alpha} I_B$

$= \frac{I_B}{1-\alpha} = 50 I_B$

$-V_T + I_B(500) + 0.7 + I_E(1000) = 0$

$-0.5V_{CC} + 500 I_B + 0.7 + (1000)50(I_B)_{20}$

$-0.5V_{CC} + 50,500 I_B + 0.7 = 0$

$I_B = \frac{0.5V_{CC} - 0.7}{50,500}$

$= 8.5148 \times 10^{-5}$ ✱

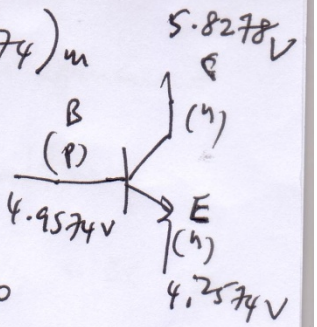
$I_C = \beta I_B = \frac{\alpha}{1-\alpha} I_B = 4.1732\,mA$

$I_E = 50(8.5148 \times 10^{-5}) = 4.2574\,mA$ ✱✱

$V_{CE} = V_{CC} - I_C(1k) - I_E(1k)$ ✱

$\therefore V_{CE} = 10 - 1k(4.1722 + 4.2574)m$

$= 1.5704\ V$ #



If R_1 is 9kΩ.

$R_T = 900$

$V_T = \frac{1k}{10k}(10) = 1\ V$

$-1 + I_B(900) + 0.7 + (1000)50I_B = 0$

$-1 + I_B(900 + 50000) + 0.7 = 0$

$I_B = \frac{1 - 0.7}{50\,900} = 5.8539\,\mu A$ #

$I_C = 49(5.8539\mu) = 0.2888\ mA$ #

$I_E = 50(5.8539\mu) = 0.2947\ mA$ #

BC is rb

$V_{CE} = 10 - 1k(0.2888 + 0.2947)m = 9.4165\ V$

$V_C = V_{CE} + I_E R_E$

$V_C = 9.4165 + I_E(1k) = 9.7112\ V$ #

$V_B = V_{BE} + I_E(1k) = 0.9947\ V$

BE is fb

$V_E = I_E(1k) = 0.2947\ V$

∴ Transistor is still in the active mode. Although R_1 has been changed, transistor is still in active.

Comment

When all resistors are 1kΩ, the quiescent point is close to the saturation region although it is still in the active region as BE fb & BC rb. When R_1 is 9kΩ, the Q-point is close to the cut-off region although the mode of operation is still active.