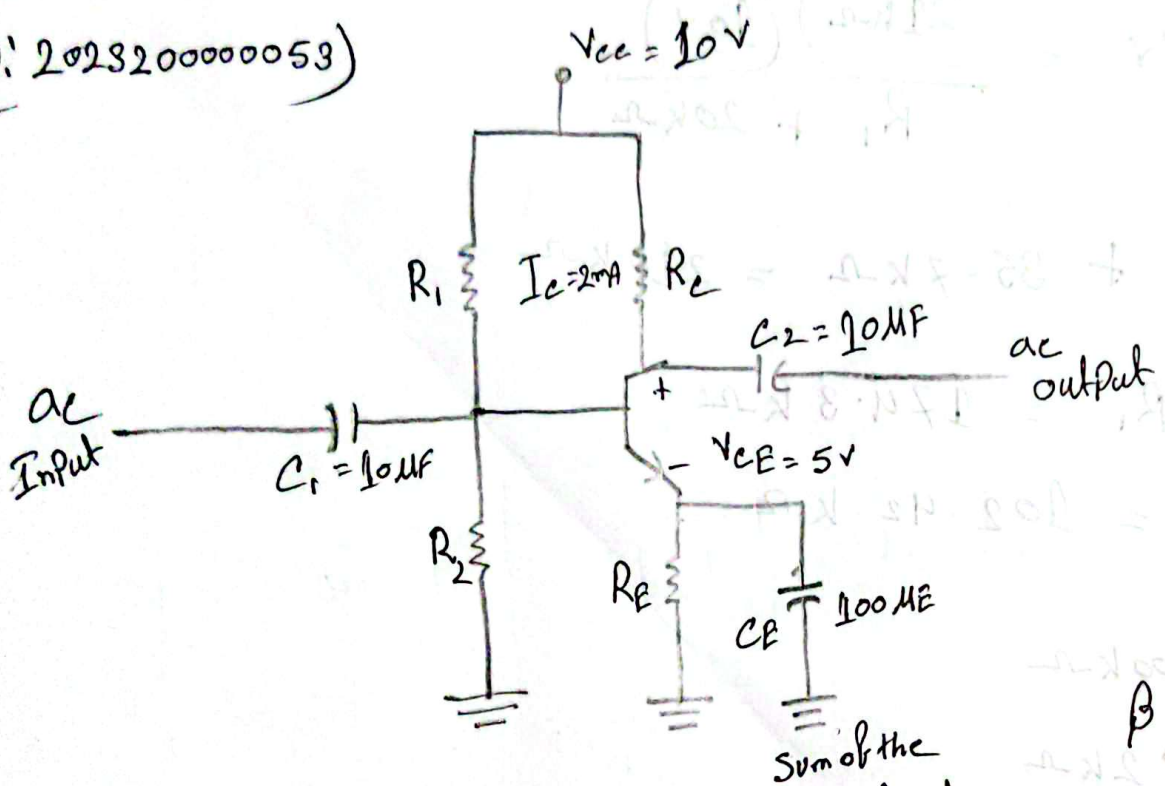
Problem-1

(ID: 20232000000053)



$\beta = 420 \text{ min}$

My student ID = 20232000000053, So, last digit is = 0+5+3 = 8

So, the number in even and I need to solve BC547C

From google $I_C = 2mA$, $V_{CE} = 5V$, $V_{cc} = 10V$, $\beta = 420 (min)$

Soln:

$$V_E = \frac{1}{10} V_{cc} = \frac{1}{10}(10V) = 1V$$

$$R_E = \frac{V_E}{I_E} \simeq \frac{1V}{2mA} = 500\Omega$$

$$R_C = \frac{V_{Rc}}{I_C} = \frac{V_{cc} - V_{CE} - V_E}{I_C} = \frac{10 - 5 - 1}{2mA} = 2k\Omega$$

$$V_B = V_{BE} + V_E = 0.7V + 1V = 1.7V$$

$$R_2 \leq \frac{1}{10} \beta R_E$$

$$V_B = \frac{R_2}{R_1 + R_2} V_{cc}$$

$$R_2 \leq \frac{1}{10}(420) \times (0.5\,k\Omega) = 20k\Omega$$

$$V_B = 1.7V = \frac{(21k\Omega)(10V)}{R_1 + 20k\Omega}$$

Or,

$$1.7R_1 + 35.7k\Omega = 210k\Omega$$

Or, $1.7R_1 = 174.3\,k\Omega$

$$R_1 = 102.42\,k\Omega$$

$\therefore R_E = 500k\Omega$

$R_C = 2k\Omega$

$R_1 = 102k\Omega$

$R_2 = 20k\Omega$

Problem - 2: ID = 053

So Sum of the last digits = 0+5+3
= 8, it's even

So, I've to design 9V relay module.

From the data sheet we get,

$I_{csat} = 50mA$

$\Rightarrow I_{csat} = \frac{V_{cc}}{R_c}$

$\Rightarrow 50 \times 10^{-3} = \frac{5}{R_c}$

$\Rightarrow R_c = \frac{5}{50 \times 10^{-3}}$

$\therefore R_c = 100\Omega$

$\beta = 135$

$I_c' = \frac{I_{csat}}{\beta} = \frac{50 \times 10^{-3}}{135}$

$= 370.37\mu A$

$I_B > I_B'$

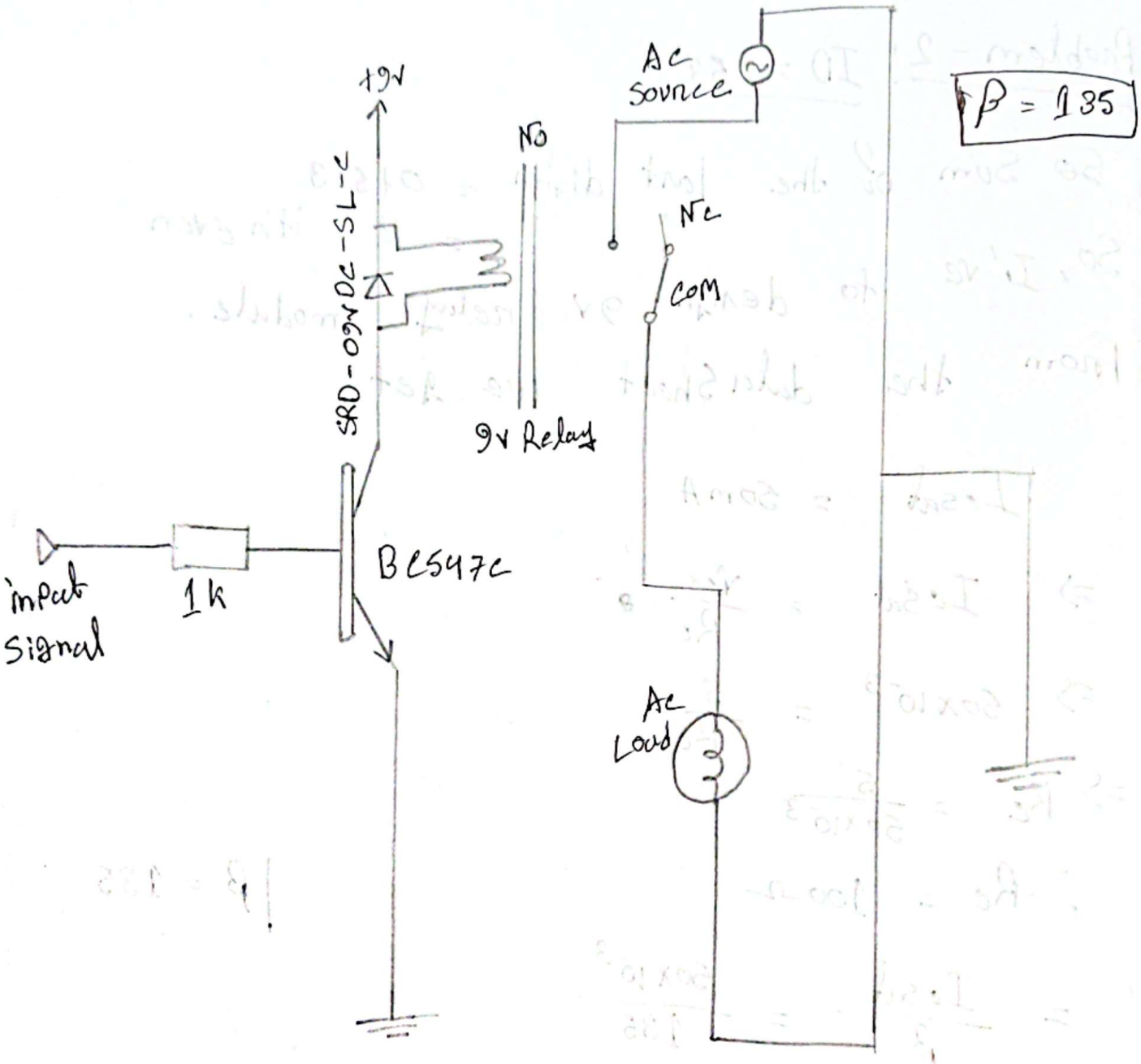
Let,

$I_B = 740.74\mu A$

$I_B = \frac{V_{cc} - V_{BE}}{R_B}$

$\Rightarrow 740.74 \times 10^{-6} = \frac{5 - 0.7}{R_B}$

$\therefore R_B = 5805\Omega$



Note: Relay model number = SRD-09VDC-SL-C

Resistor values : $R_B = 5805\,\Omega$, $R_C = 100\,\Omega$

$V_{CC} = 5V$

PIN names : (i) Signal

(ii) Ground

(iii) V_{CC}