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(1) So,

$1+3+1 = 5$ (odd), So the BJT is BC548.

Collecting datasheet.

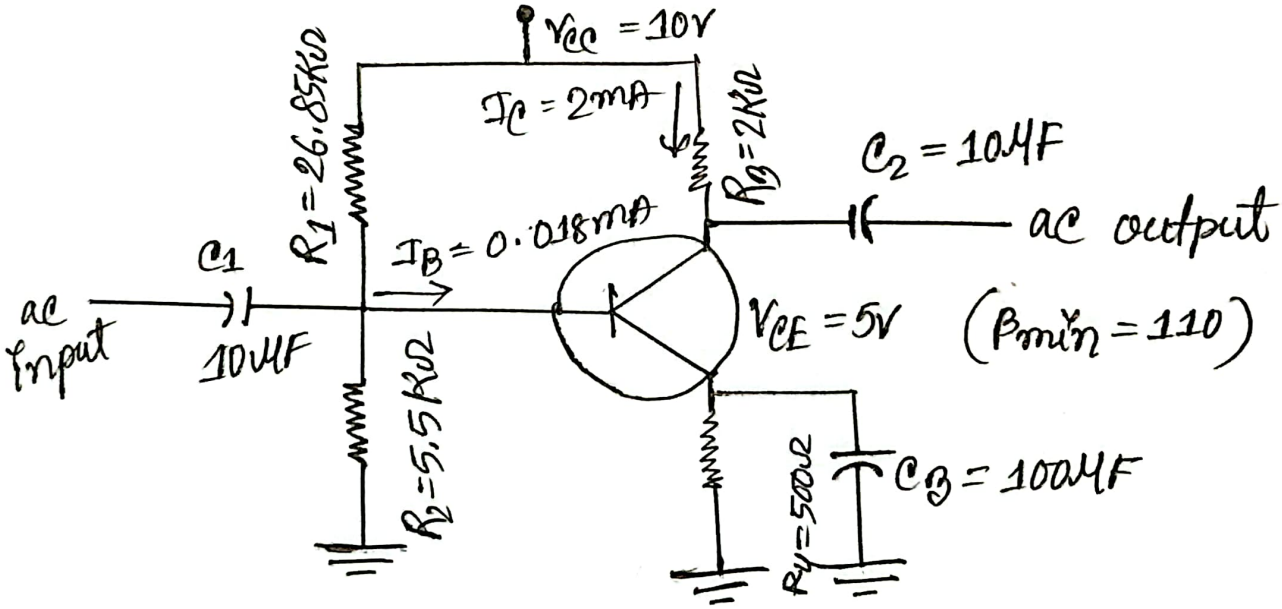
$I_C = 2.0\,mA$, $V_{CE} = 5.0V$

$\beta(min) = 110$

$V_{CC} = 2V_{CE} = 10V$

$$I_B = \frac{I_C}{\beta} = \frac{2mA}{110} = 0.01818\,mA$$

$$= 18.18 \times 10^{-3}\,mA$$



$$V_E = \frac{1}{10} V_{CC}$$

$$= \frac{1}{10} \times 10$$

$$= 1V$$

$$R_4 = R_E = \frac{V_E}{I_E} = \frac{V_E}{I_C} = \frac{1}{2 \times 10^{-3}}$$

$$= 500\Omega$$

$$V_{RC} = V_{CC} - V_{CE} - V_E$$
$$= 10 - 5 - 1$$
$$= 4V$$

$$\therefore R_C = \frac{V_{RC}}{I_C}$$
$$= \frac{4V}{2\times10^{-3}A}$$
$$= 2000\Omega = 2K\Omega$$

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

Now,
$$V_B = \frac{R_2}{R_1 + R_2} V_{CC}$$
$$\Rightarrow 1.7 = \frac{5.5}{R_1 + 5.5} \times 10$$
$$\Rightarrow R_1 = 26.85K\Omega$$

$$R_2 \leq \frac{1}{10} \beta R_E$$
$$\Rightarrow R_2 \leq \frac{1}{10} \times 110 \times 500\Omega$$
$$\therefore R_2 \leq 5.5K\Omega$$

Now, $$r_e = \frac{26mV}{I_E} \simeq \frac{26mV}{I_C} = \frac{26mV}{2mA} = 13\Omega$$

input impedence, $Z_{in} = R_1 \| R_2 \| \beta r_e$
$$= \left(\frac{1}{26.85} + \frac{1}{5.5} + \frac{1}{110\times13\times10^{-3}}\right)^{-1}$$
$$= 1.088K\Omega$$

output impedence, $Z_{out} = R_e \| r_o$ $[r_o = \infty]$
$$= \left(\frac{1}{R_e} + \frac{1}{r_o}\right)^{-1}$$
$$= \left(\frac{1}{R_C} + \frac{1}{\infty}\right)^{-1}$$
$$= R_e$$
$$= 2K\Omega$$

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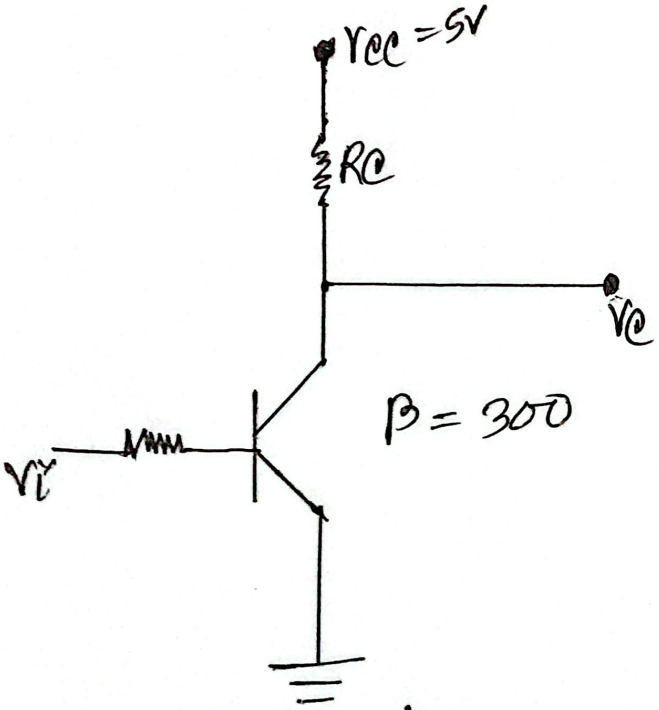
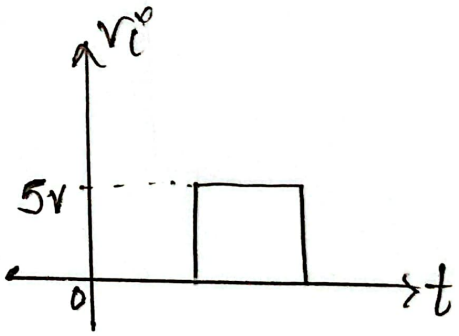
The sum of the last 3 digit $(1+3+1) = 5$; odd
So, I Design a 5v relay module circuit.
Use, SRD-05VDC-SL-C
Here,
$I_{C\,sat} = 89.3$ [Datasheet]
Using BC548 BJT
For 89.3 mA, $\beta = 300$ (110-800)



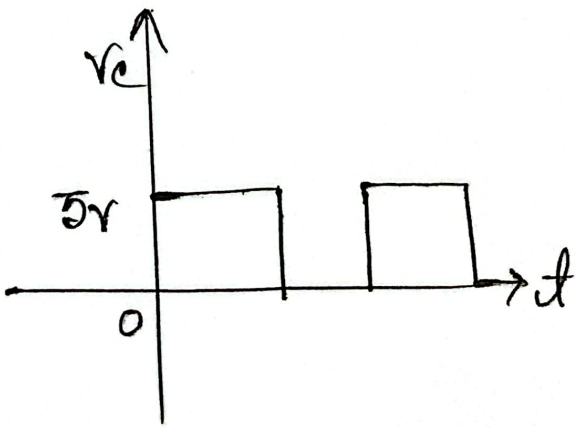


$$I_B > \frac{I_{C\,sat}}{\beta}$$

$$\Rightarrow I_B > \frac{89.3}{300}$$

$$\therefore I_B > 0.2977\ mA$$

Let, $I_B = 0.35\ mA$



$$\therefore R_B = \frac{V_i - 0.7}{I_B}$$

$$= \frac{5 - 0.7}{0.35}$$

$$= 12.285\ K\Omega$$