Assignment : 02

Problem : 1

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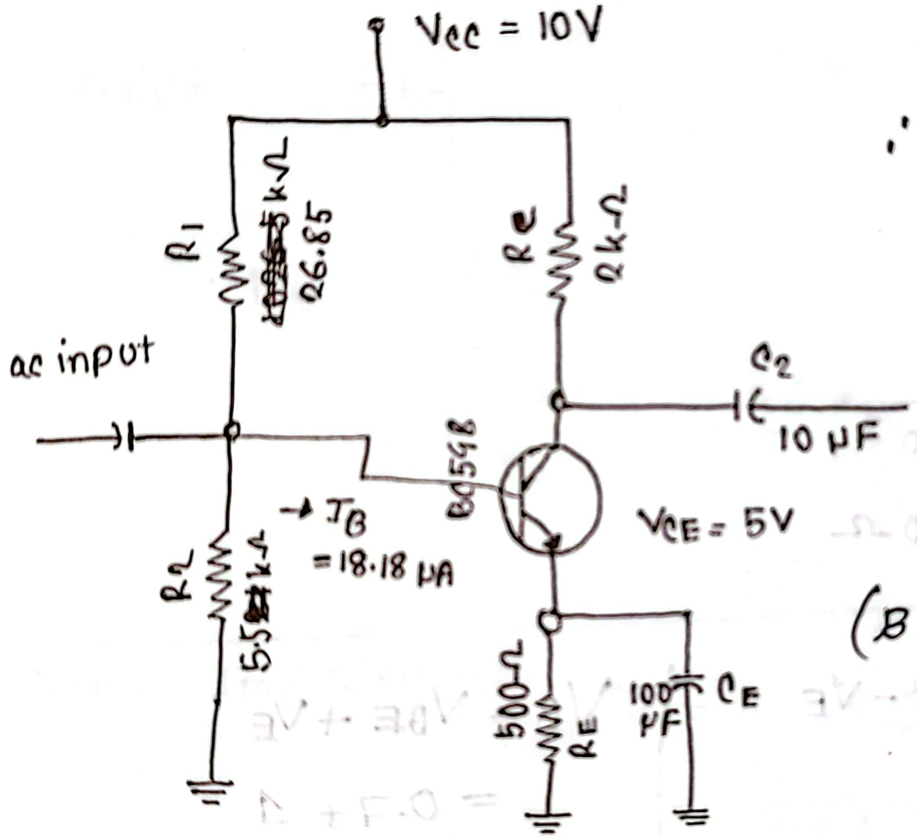
$X = 6+5+6$

$= 17$ (ODD)

$\therefore$ BJT MODEL

BC 548



($\beta_{min} = 110$)

From BC548 model Datasheet,

$I_C = 2$ mA

$V_{CE} = 5$ V

Input AC Voltage

$= (6+5+6) \div 3$

$= 5.67$ mv

$$I_B = \frac{I_c}{\beta} = \frac{2mA}{110} = \cancel{0.02}\ 0.01818\ mA$$

$$= 18.18\ \mu A$$

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

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

$$= 1V$$

$$R_E = \frac{V_E}{I_E} \approx \frac{V_E}{I_c}$$

$$= \frac{1}{2\times 10^{-3}}$$

$$= 500\Omega$$

$$V_{RC} = V_{CC} - V_{CE} - V_E$$

$$= 10 - 5 - 1$$

$$= 4V$$

$$V_B = V_{BE} + V_E$$

$$= 0.7 + 1$$

$$= 1.7\ V$$

$$\therefore R_C = \frac{V_{RC}}{I_c} = \frac{4}{2\times 10^{-3}}$$

$$= 2000\Omega$$

$$= 2k\Omega$$

Now,

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

$$\Rightarrow 1.7 = \frac{5.5}{R_1 + 5.5} \times 10$$

$$\Rightarrow R_1 = 26.85 \ k\Omega$$

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

$$\Rightarrow R_2 = \frac{1}{10} \times 110 \times 500 \ \Omega$$

$$\therefore R_2 = 5.5 \ k\Omega$$

$$r_e = \frac{26 \ mV}{I_E}$$

$$= \frac{26 \ mV}{I_C}$$

$$= \frac{26 \ mV}{2 \ mA}$$

$$= 13 \ \Omega$$

Input impedence, $Z_{in} = R_1 \| R_2 \| \beta r_e$

$$= \left(\frac{1}{102.5} + \frac{1}{5.5} + \frac{1}{\beta(13\times10^{-3})} \right)^{-1}$$

$$= 1.1225 \ k\Omega$$

Output impedence, $Z_{out} = R_C \| r_o$

$$= \left(\frac{1}{R_C} + \frac{1}{r_o} \right)^{-1}$$

$$= \left(\frac{1}{R_C} + \frac{1}{\infty} \right)^{-1}$$

$$= \left(\frac{1}{R_C} \right)^{-1}$$

$$= R_C$$

$$= 2 k\Omega$$

Input AC $v = (6 + 5 + 6) \div 3$

$$= 5.67 \ V$$

$x = 6 + 5 + 6$

$= 17 == \text{ODD}$

BJT Model- BC548

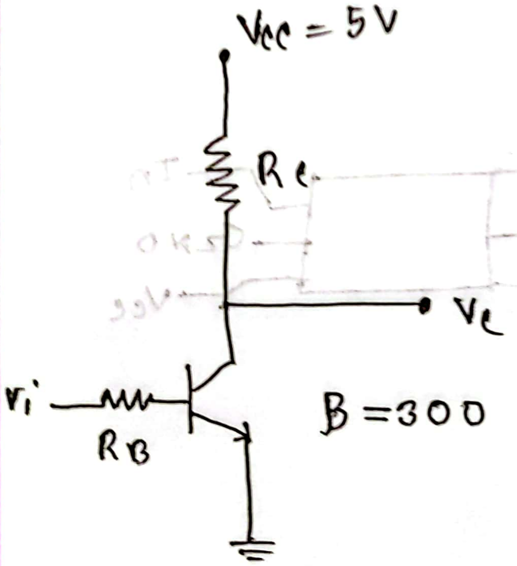
5V relay module circuit :

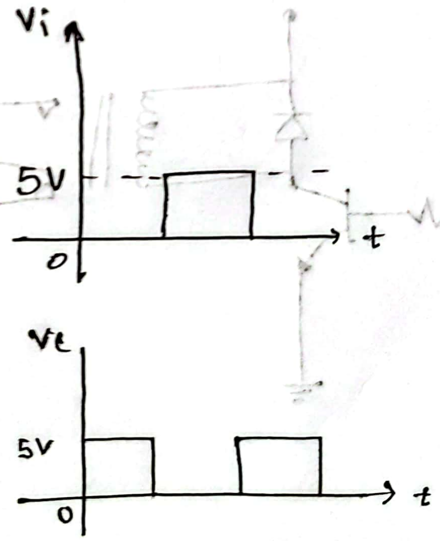
SRD- 05VDC-SL-C

From datasheet,

$I_{Csat} = 89.3$

$\beta = 300$





$$I_B > \frac{I_{Csat}}{\beta}$$

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

$\therefore I_B > 0.2977 \ mA$

Let, $I_B = 0.35 \ mA$

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

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

$$= 12.285 \ k\Omega$$