IES – 2013 [SET B]

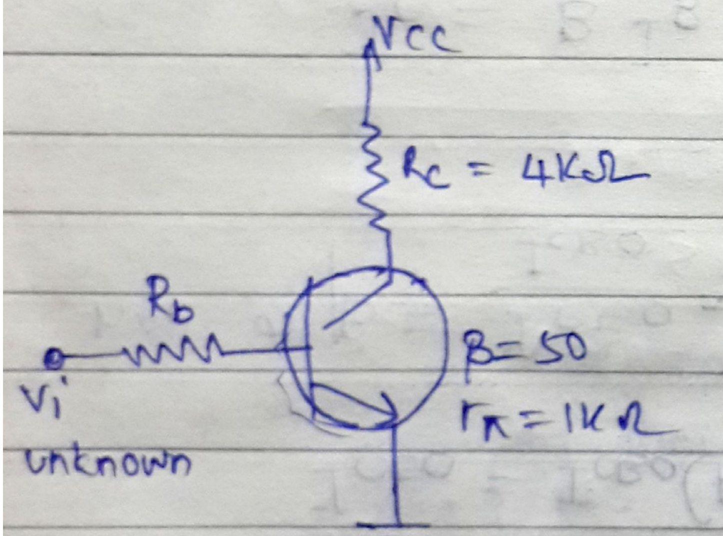
[PAPER – II]

Electronics & Telecommunication

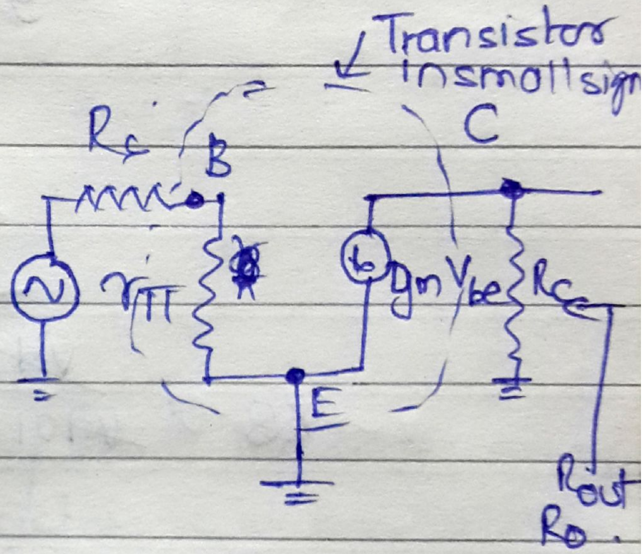
Q21. A CE Amplifier has resistor R_F connected b/t collector & base $R_F = 40K$, $R_C = 4k\Omega$, Given $h_{fe} = 50$, $r_\pi = 1k\Omega$, output resistance is:

Solution

$R_F = 40K$, $R_C = 4k\Omega$, h_{fe} or $\beta = 50$, $r_\pi = 1k\Omega$



(a) CE Amplifier



(b) CE Amp. in r_π model.

Now here

- R_{in} (Does not include source)
  $R_{in} = r_\pi = 1k\Omega$
- R_{out} or R_O (Does not include load)
  so
  $R_C = R_O = 4k\Omega$.

So Ans : (c) 4kΩ

Q22 If $I_{CEO} = 410\mu A$, $I_{CEO} = 5\mu A$ & $I_B = 30\mu A$, then collector current (I_c).

Sol^n Collector current & current (base) & reverse saturation current.

$$I_c = \beta I_B + I_{CBO}(\beta + 1) \quad \text{--- (1)}$$

$$\therefore I_c = \beta I_B + I_{CEO} \quad \text{--- (2)}$$

from (1) & (2)

$$I_{CEO} = I_{CBO}(\beta + 1). \quad \text{--- (3)}$$

$$h_{fe} \text{ or } \beta = \frac{I_{CEO}}{I_{CBO}} = \frac{410\mu A}{5\mu A} = 82$$

$$I_c = \beta I_B.$$

$$= 82 \times 30 \times 10^{-6} A$$

$$= \quad 2.46 \text{ mA}$$

$$I_c = 2460 \mu A \text{ or } \text{ mA}$$

There is No such option

24. The transistor as shown in the circuit is operating in

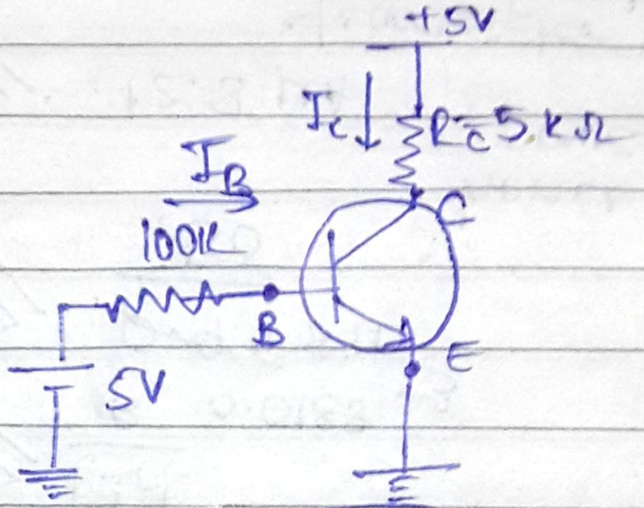


Fig Q24.

(a) cutoff
(b) saturation
(c) Active Region
(d) Saturation or Active region.

Solution

Test of saturation region:

Test -1

Determine I_C & I_B separately from the circuit config. under consideration. The transistor is in saturation. if $|I_B| \geq |I_C|/\beta$.

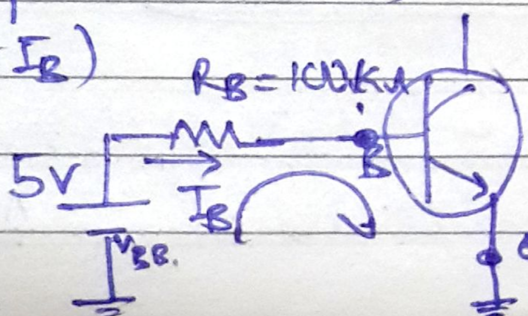
Let us check. Test 1

Given — Lets assume

$V_{BB} = 5V$, $V_{BE(sat)} = 0.7V$, $V_{CE(sat)} = 0.3V$,

$R_B = 100K$, $V_{CC} = 5V$, $\beta = 50$ (Assume)

Base loop (Calculation of I_B)



$$I_C = \frac{V_{BB} - V_{BE}}{R_B}.$$

$$I_B = \frac{5V - 0.7V}{100K}$$

$$I_B = \frac{4.3}{100K} A \quad \text{or} \quad \boxed{I_B = 43 \mu A}$$

Calculation of Collector current (I_c).

$$I_c = \frac{V_{CC} - V_{CE}}{R_C}$$

$$I_c = \frac{5V - 0.3V}{5K} = 0.94 \text{ mA}$$

$$\boxed{I_c = 0.94 \text{ mA}}$$

Now check

$$|I_B| \geq \frac{|I_c|}{\beta}$$

$$43 \mu A \geq \frac{0.94 \times 10^{-3}}{50} \quad 0.0188$$

$$\boxed{43 \mu A \geq 18.8 \mu A}$$

hence proved

transister is in saturation.

Ans: Saturation Region

Q29 The amplifier A shown in the figure has open loop gain of 100, input impedance Z_i of $1k\Omega$ & output impedance Z_o of 100Ω. If negative feedback factors $\beta = 0.99$ is used, the new values of Z_i and Z_{out} are respectively,

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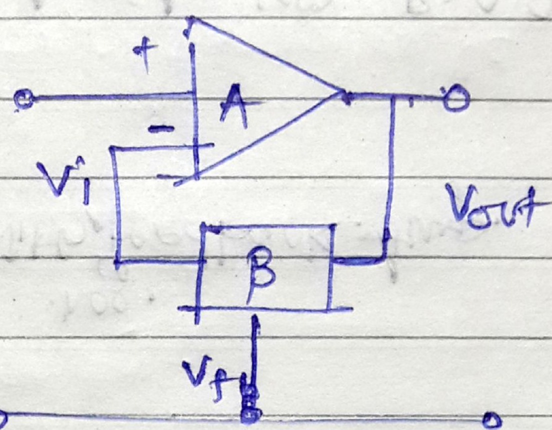
Given

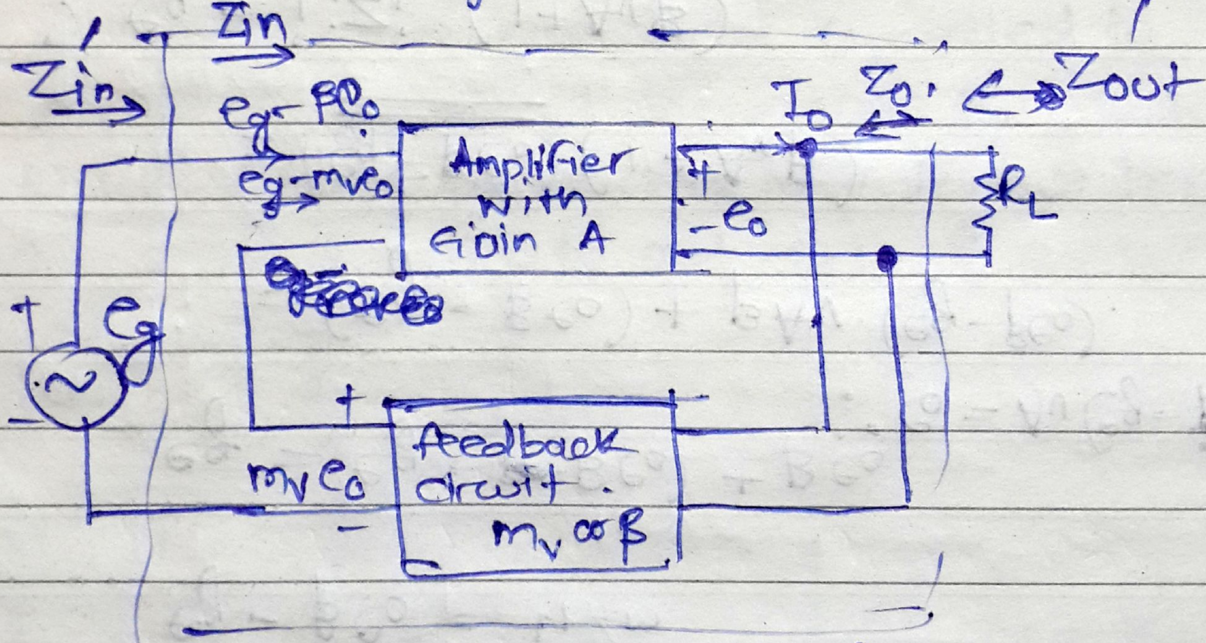
$Z_i = 1K\Omega$

$Z_{out} = 100\Omega$

$A = 100$, $\beta = 0.99$



Let Z_{in}' & Z_{out}' will be the new impedance of the closed loop negative feedback amplifier.



m_v or β = feedback amplifier.

e_g = energy generator/voltage.

e_o = output voltage.

Z_i' = New i/p impedance

Z_o' = New o/p impedance

i_1 = current

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From Fig

$$e_g - \beta e_0 = i_1 Z_{in}$$

$$e_g = (e_g - \beta e_0) + \beta e_0 \qquad \because e_0 = A_v(e_g - \beta e_0)$$

$$= (e_g - \beta e_0) + \beta A_v (e_g - \beta e_0).$$

$$= (e_g - \beta e_0)(1 + A_v \beta)$$

$$e_g = i_i Z_i (1 + A_v \beta)$$

or

$$\frac{e_g}{i_1} = Z_i (1 + A\beta)$$

New Impedance with neg. feedback Amp.

$$Z_i' = Z_i (1 + A_v \beta)$$

Now given $Z_i = 1 k\Omega$, A_v or $A = 100$, $\beta = 0.99$

$$Z_i' = 1 k\Omega (1 + 100 \times 0.99)$$

$$Z_i' \approx 100 k\Omega$$

similary

$$Z_{out}' = \frac{Z_{out}}{(1 + A\beta)}$$

$Z_{out} = 100\Omega$, $A = 100$, $\beta = 0.99$

$$Z_{out}' = \frac{100}{(1 + 100 \times 0.99)} = \frac{100}{100} = 1\Omega$$

$$\boxed{Z_{out}' = 1\Omega}$$

Ans (c) $Z_{in}' = 100k\Omega$ & $Z_{out}' = 1\Omega$

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(8) A 5mV, 1KHz sine wave signal is applied to the signal to an OPAMP. Integrator for which R = 100 Ω (But Question it is 100KΩ but I think it was wrong according to options) & C = 1NF. The o/p voltage.

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