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ALM-2 Quiz/Test Question

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1) The Q-point in the active region ensure that the transistor work!

Ans: A) Amplifier

2) In Voltage divider bias, the Q-point is

B) independent of β

3) Given $V_{cc} = 12V$, $R_c = 2k\Omega$, $R_E = 1k\Omega$ $\beta = 180$, plot Dc load line and determine the Q-point (I_c and V_{ce})!

Ans:

Given data:

$V_{cc} = 12V$, $R_c = 2k\Omega$, $R_E = 1k\Omega$ $\beta = 180$

Apply kvl at output loop

$$V_{cc} - I_c R_c - I_c R_E - V_{ce} = 0$$

$$V_{cc} - I_c (R_c + R_E) - V_{ce} = 0$$

$$V_{ce} = V_{cc} - I_c (R_c + R_E) \rightarrow (1)$$

Collector Current $I_c = 0$

$$V_{ce} = V_{cc} - 0 (R_c + R_E)$$

$$V_{ce} = V_{cc} = 12V$$

$$\boxed{V_{ce} = 12V}$$

from eq - (1)

$$V_{cc} - I_c R_c - I_c R_E - V_{ce} = 0$$

$$V_{cc} - I_c (R_c + R_E) - V_{ce} = 0$$

$$I_c (R_c + R_E) = V_{cc} - V_{ce}$$

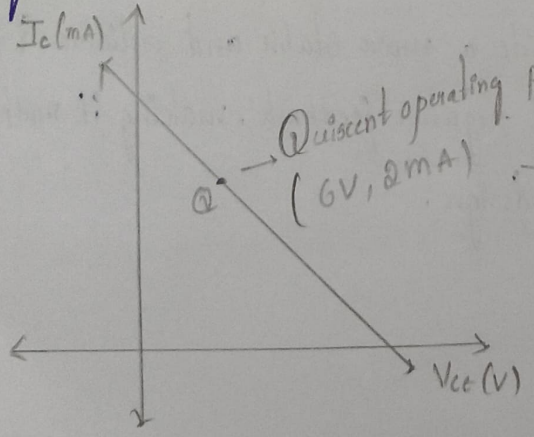
$$I_c = \frac{V_{cc} - V_{ce}}{R_c + R_E}$$

$$= \frac{V_{cc}}{R_c + R_E} = \frac{12}{2000 + 3000}$$

$$\boxed{I_c = \frac{12}{4000} = 4mA}$$

Quiscent operating point $(V_{ceQ}, I_{cQ}) = (6V, 2mA)$

→ sketching a Dc load line:

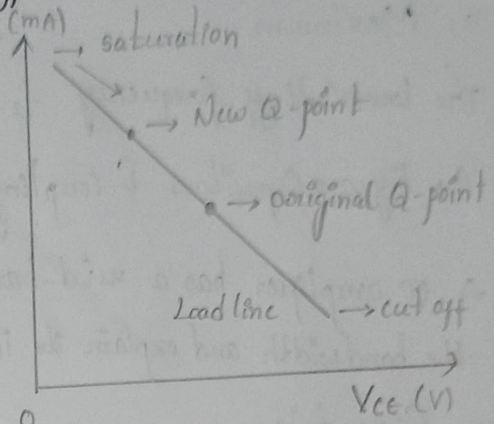


→ lies in active region.

4) If base bias is increased, show the Q-point shifts on the load line. indicate weather moves towards saturation or Cutt-off!

Ans:

The Q-point represent the DC Value of Collector emitter Voltage (V_{CE}) and Collector Current (I_C) with no input signal. it is located on the DC load line which graphically plot (I_C Vs V_{CE})



1) Increasing Base bias :→

increasing the base bias mean increasing the base Current (I_B) following to the BJT.

2) Effect on Collector Current :→

Since Collector Current is a function of the base-Current ($I_C = \beta \times I_B$), an increase I_B directly Cause increase in I_C

3) Effect on Collector-Emitter Voltage :→

The dc load line equation $V_{CE} = V_{CC} - I_C R_C$. as I_C increase, the Voltage drop across Collector resistor (R_C) increase.

∴ therefore Quisent operating lies in 'Saturation region'.

Now explain in your own words why stabilizing Q-point is Crucial for amplifier!

stabilizing the Q-point is Crucial because it ensure the amplifier operates Correctly and Consistently. if the Q-point shifts, the Output may distort or the transistor may go into Cutoff or Saturation. Temperature changes and transistor Variation Can move the Q-point. A stable Q-point keeps the signal with active region. this result is clear, undistored amplification.