Thapar Institute of Engineering & Technology, Patiala

Department of Electronics and Communication Engineering

Course Code: UEC-301; **Course Name:** Analog Electronic Circuits

B.E. (ECE/ENC) (IV-Sem)

"SOLUTION of Tutorial Sheet No. - 3"

Solution [3]

SOLUTION: Collector supply voltage, $V_{CC} = 6$ V; Collector load, $R_C = 2.5$ kΩ.

(i) We know that for faithful amplification, V_{CE} should not be less than 1 V for Si transistor.

∴ Max. voltage allowed across $R_C = V_{CC} - V_{knee} = 6 - 1 = 5$ V

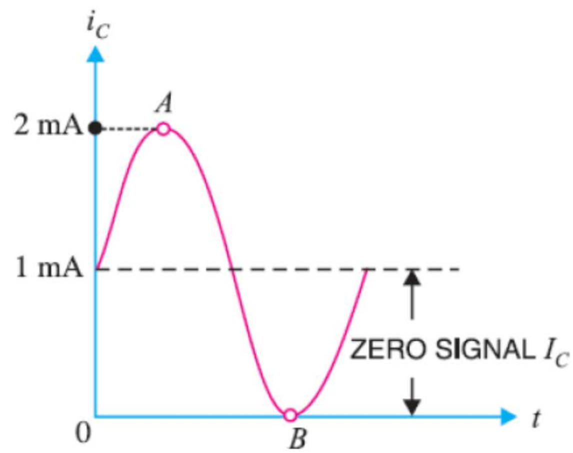
∴ Max. allowed collector current = 5 V/R_C = 5 V/2.5 kΩ = **2 mA**

SOLUTION: Thus, the maximum collector current allowed during any part of the signal is 2 mA.

If the collector current is allowed to rise above this value, V_{CE} will fall below 1 V.

Consequently, value of β will fall, resulting in unfaithful amplification.

SOLUTION:

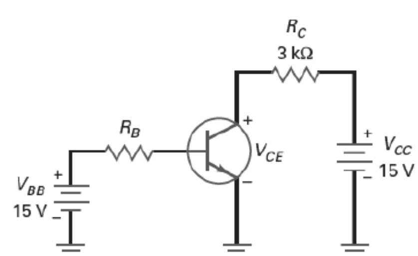


SOLUTION: (ii) During the negative peak of the signal, collector current can at the most be allowed to become zero.

As the negative and positive half cycles of the signal are equal, therefore, the change in collector current due to these will also be equal but in opposite direction.

∴ Minimum zero signal collector current required = 2 mA/2 = **1 mA**.

Solution [8]



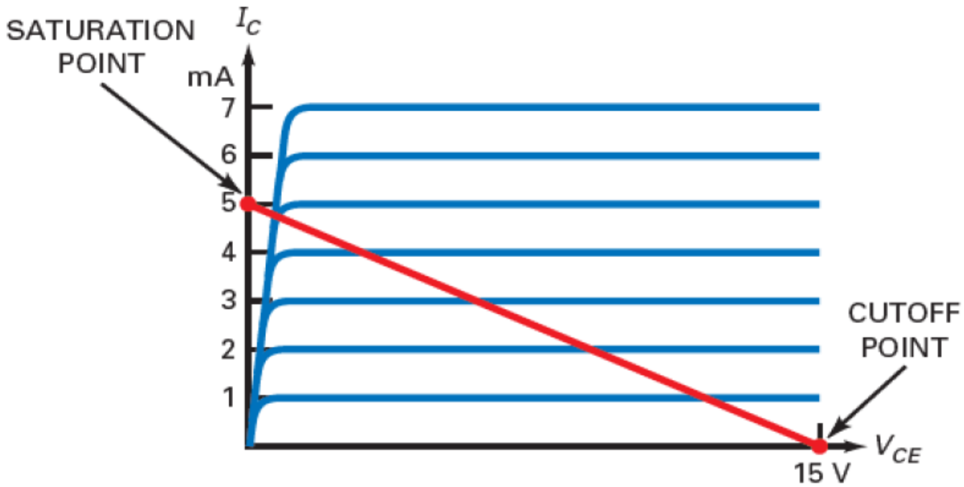
- $V_{CE} = V_{CC} - I_C R_C$

or, $I_C = \frac{V_{CC} - V_{CE}}{R_C} = \frac{15\text{ V} - V_{CE}}{3\text{ k}\Omega}$

When $V_{CE} = 0$: $I_C = 5$ mA, and

When $I_C = 0$: $V_{CE} = 15$ V.

- Therefore, the coordinates are: $I_C = 5$ mA and $V_{CE} = 15$ V.



Solution [9]

$$I_{B_Q} = \frac{V_{CC} - V_{BE}}{R_B} = \frac{12\text{ V} - 0.7\text{ V}}{240\text{ k}\Omega} = \mathbf{47.08\ \mu A}$$

$$I_{C_Q} = \beta I_{BQ} = (50)(47.08\ \mu\text{A}) = \mathbf{2.35\ mA}$$

$$\begin{aligned} V_{CE_Q} &= V_{CC} - I_C R_C \\ &= 12\text{ V} - (2.35\text{ mA})(2.2\text{ k}\Omega) \\ &= \mathbf{6.83\ V} \end{aligned}$$

$V_B = V_{BE} = \mathbf{0.7\ V}$

$V_C = V_{CE} = \mathbf{6.83\ V}$

Using double-subscript notation yields

$$\begin{aligned} V_{BC} &= V_B - V_C = 0.7\text{ V} - 6.83\text{ V} \\ &= \mathbf{-6.13\ V} \end{aligned}$$