G.W.P.C, Ajmer

Electronics Department

E.D.C. (EL204)

II Mid Term

Max. Marks - 15

Time - 1 Hour

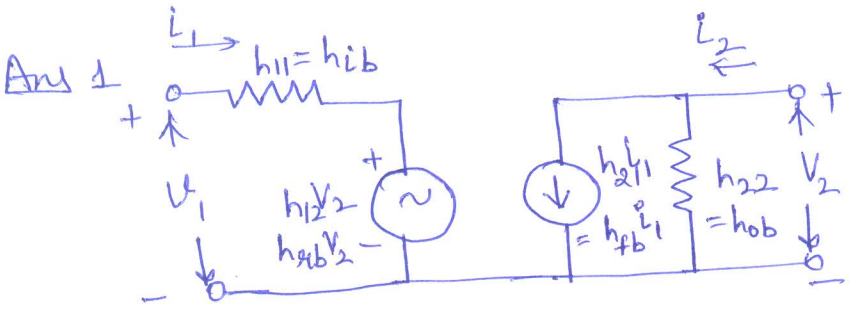
Date - 9/1/2018

Name :- Mrs. BHAWNA MATHUR

Ans 1

Q. 1 Draw the common base (CB) low frequency small signal hybrid model of BJT and explain it (5)

Ans 1



Every linear circuit is associated with h-parameters. When this linear circuit is terminated by load R_L, we can find i/p impedance, current gain, voltage gain etc. in terms of h parameter. For small a.c signals transistor behaves as a linear device. There are four quantities required to describe the external behaviour of the Transistor amplifier. These are V_1, i_1, V_2 and i_2.

V_1 = I/p voltage, i_1 = I/p current

V_2 = o/p voltage, i_2 = o/p current

These voltages and currents can be related by the following sets of equations for CB :-

$$V_1 = h_{ib} i_1 + h_{rb} V_2$$

$$i_2 = h_{fb} i_1 + h_{ob} V_2$$

For common base -

$V_1 = V_{EE}$, $V_2 = V_{CC}$

$i_1 = I_b$, $i_2 = I_c$

So hybrid parameter equation is

$V_{EE} = h_{ib} I_b + h_{rb} V_{cc}$ — (1)

$I_c = h_{fb} I_b + h_{ob} V_{cc}$ — (2)

If we short circuit the o/p terminals $V_{cc} = 0$

then $h_{ib} = \frac{V_{EE}}{I_b}$ for $V_{cc} = 0$ = I/p impedance when o/p is short circuited.

$h_{fb} = \frac{I_c}{I_b}$ for $V_{cc} = 0$ = current gain when o/p is short circuited.

When we open circuit the input terminals $I_b = 0$ then

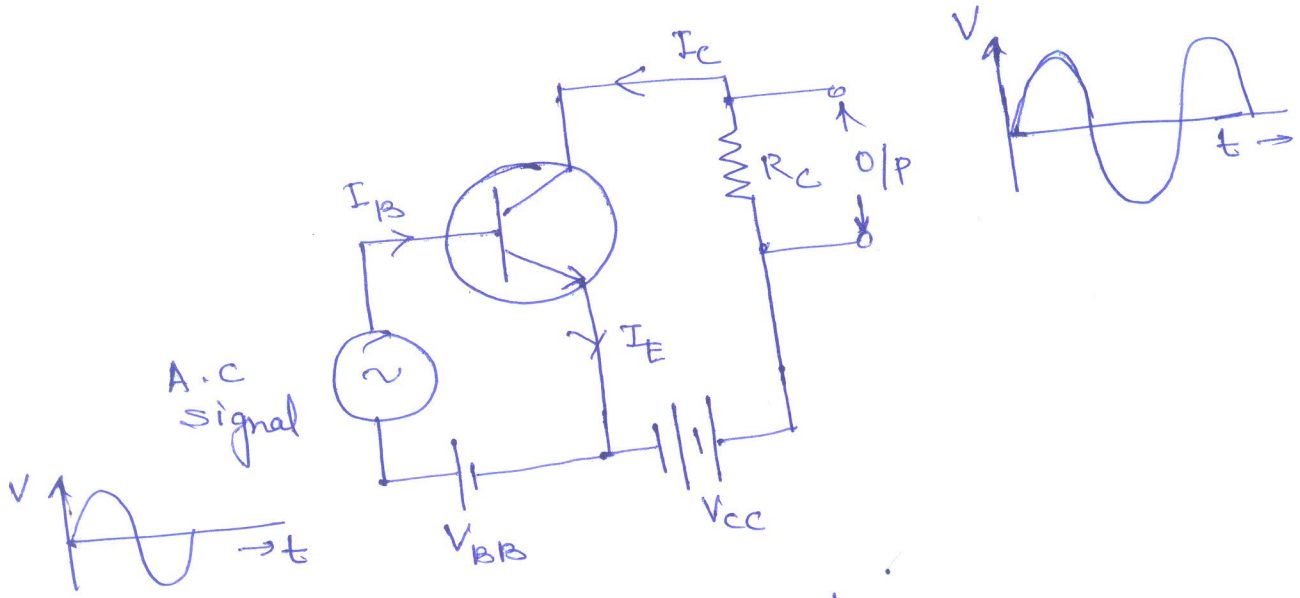
$h_{rb} = \frac{V_{EE}}{V_{cc}}$ for $I_b = 0$ ⇒ reverse voltage gain when I/p is open circuited.

$h_{ob} = \frac{I_c}{V_{cc}}$ for $I_b = 0$ ⇒ output admittance when I/p is open circuited.

Q.2 Explain the working of transistor as an amplifier.

Ans 2 NPN transistor in CE configuration is shown. During the positive half cycle of the signal, the forward bias across the emitter base junction is increased. Therefore more electrones flow from the emitter to the collector via the base. This causes an increase in collector current. The increased collector current produces a greater voltage drop across the collector load resistance R_c.

However during the negative half cycle of the signal, the forward bias across Emitter Base junction is decreased. Therefore collector current decreases. This results in the decreased output voltage (in the opposite direction). Hence, an amplified output is obtained across the load.



NPN CE Amplifier

Q.N3 In BJT prove that

$$\beta = \frac{\alpha}{1-\alpha}$$

Ans 3 In CE current gain $\beta = \frac{\Delta I_C}{\Delta I_B}$ —— (1)

In CB current gain $\alpha = \frac{\Delta I_C}{\Delta I_E}$

Now $I_E = I_B + I_C$

$\Delta I_E = \Delta I_B + \Delta I_C$

or $\Delta I_B = \Delta I_E - \Delta I_C$

put the value of ΔI_B in (1) eqn

$$\beta = \frac{\Delta I_C}{\Delta I_E - \Delta I_C}$$

Divide Nr. & Dr. by ΔI_E

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$$\beta = \frac{\Delta I_C / \Delta I_E}{(\Delta I_E - \Delta I_C)/\Delta I_E}$$

$$= \frac{\Delta I_C / \Delta I_E}{1 - \Delta I_C / \Delta I_E}$$

$$\beta = \frac{\alpha}{1-\alpha}$$

Hence Proved.

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(भावना माथुर)