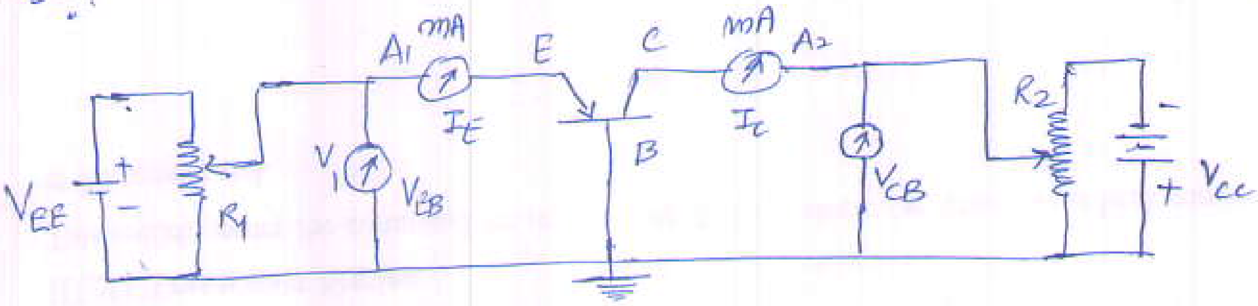
EL-204 Electronics Devices & circuits

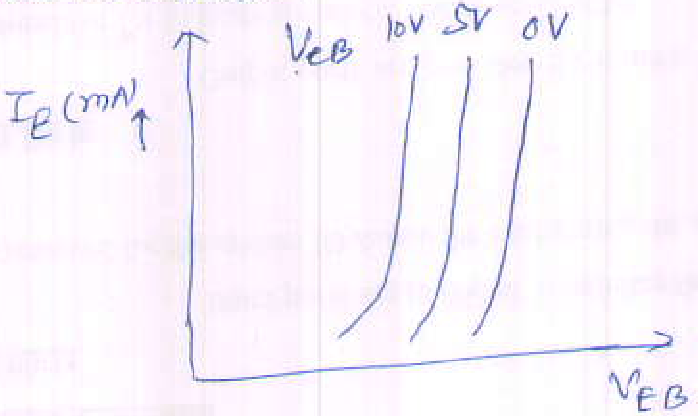
IInd Test, 16/1/18

Q1. Explain input and output characteristics of common base configuration of transistor. ?

Ans:



(i) Input characteristics : The curve between emitter current I_E and emitter base voltage (V_{EB}) at constant collector base voltage V_{CB} represents the input characteristics.



(i) There exists a cut in, offset or threshold voltage V_{EB} below which the emitter current is very small

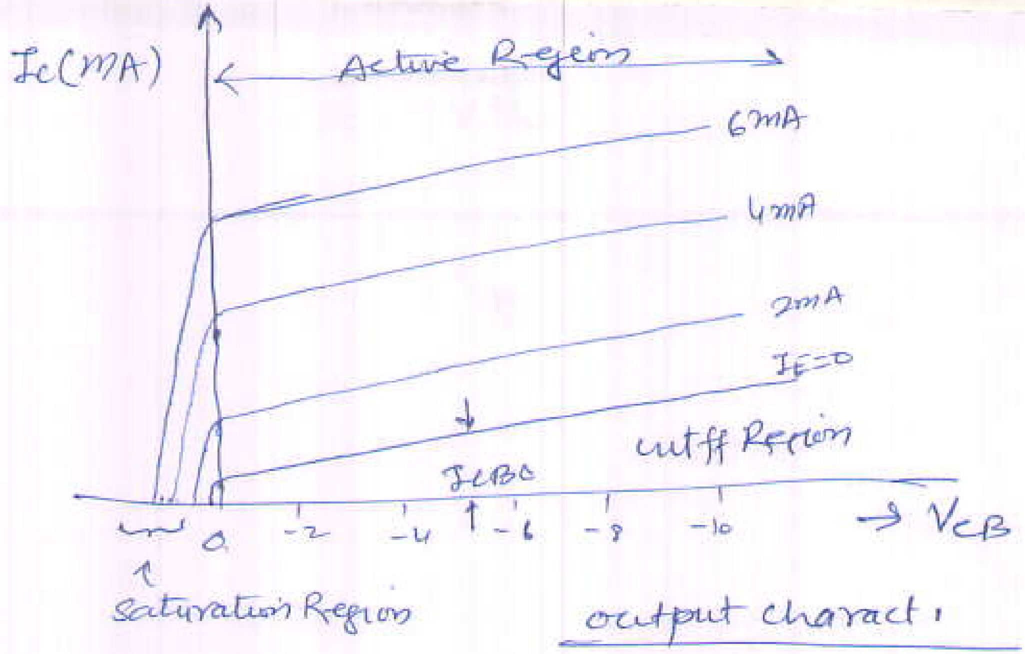
(ii) The emitter current I_E increases rapidly with small increase in emitter base voltage V_{EB}. This shows that the input resistance is very small.

output characteristics The curve between collector current I_C and collector base voltage V_{CB} at constant emitter current I_E represents output characteristics

(1) In active region I_C is independent of collector voltage but depends only on I_E

(2) In cut off Region small I_C flows when $I_E = 0$

(3) Saturation region : ~~When~~ I_C flows even when $V_{CB} \simeq 0$



output charact.

Q.2. Explain (i) Thermal runaway
(ii) Thermal stability

Ans.
(i) Thermal runaway: When collector current flows in a transistor, it is heated i.e. its temperature increases. If no stabilization is done, the collector leakage current also increases. This further increases transistor temperature. Consequently, there is a further increase in leakage current. The action become comulative and the transistor may ultimate burn out. This self destruction of transistor is known as thermal runaway.

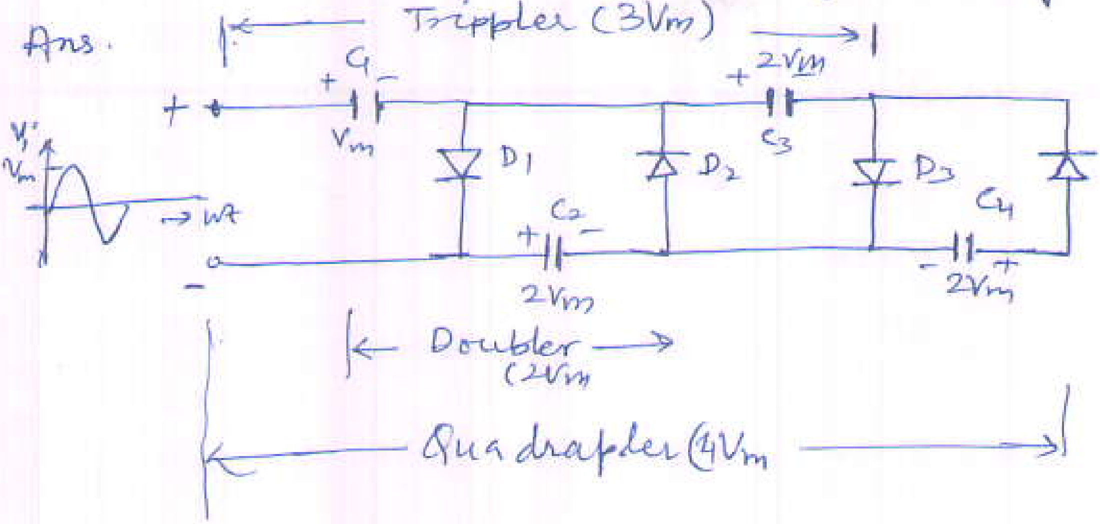
(ii) To maintain the operating point stable against the variation of Temperature, individual variation and thermal runaway, is known as thermal stability or stabilization.

Stability factor $S = \frac{\Delta I_C}{\Delta I_{CO}}$

When of S is smaller, higher the stability.

Q3. Write a short note on voltage multiplier?

Ans.



In the above arrangement of voltage multiplier during positive half cycle, the diode D_1 conducts charging C_1 to V_m (Peak value) with shown polarity. In the first negative half cycle, the diode D_2 conducts so that C_2 gets charged to voltage $2V_m$ because the input voltage V_m is in series with the capacitor C_1 voltage V_m. In this process the charge on capacitor C_1 starts discharging. In the second positive half cycle the diode D_1 and D_3 are forward biased and conducts. During second negative half cycle, the diode D_2 and D_4 will conducts charging C_4 to a voltage $2V_m$.

$$V_{C_4} = V_m - V_{C_2} + V_{C_3} + V_{C_1}$$

$$= 2V_m$$

Now voltage across C_1, C_2, C_3 and C_4 are V_m, $2V_m$, $2V_m$ and $2V_m$ respectively.

So we can take output as our requirement across C_2 (doubler), across C_1 & C_3 (Trippler) and across C_2 and C_4 (quadrapler)

Q4. Define
(i) stability factor (ii) operating point

Ans: Stability factor

It is defined as rate of change of collector current I_C with respect to reverse saturation current I_{CO}, keeping β and V_{BE} constant.

$$S = \frac{\Delta I_C}{\Delta I_{CO}}$$

Stability factor S_β rate of change of I_C with respect to β keeping I_{CO} and V_{BE} - constant

Stability factor S_V rate of change of I_C with respect to V_{BE}, keeping I_{CO} and β constant.

Operating point It is a point on dc load line which represents the value of I_C and V_{CE} that exists in a transistor circuit when no signal is applied. It is also known as quiscent point or working point.