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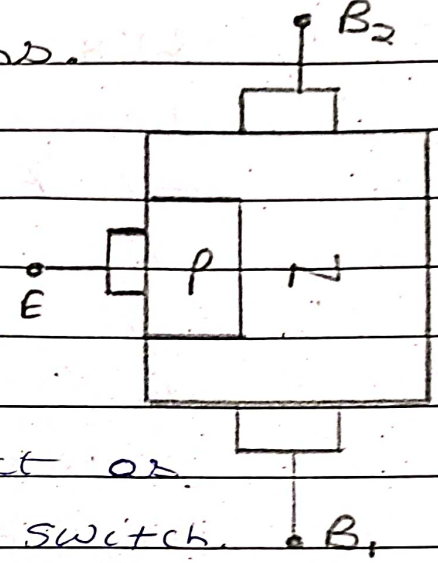
Assignment:-

Q. Describe the working of UJT along with its applications.

- UJT stands for Unipolar Junction transistor.
- It is a semiconductor with only one j.n and 3 terminals
- Its primary f.n is to act as an electrically controlled switch.



→ Working :-

- With E Open.

When V_{BB} is applied at emitter open, A potential gradient is established along the n-type Si bar. As the emitter is located close to the 'Base' B_2, thus a major part of V_{BB} appears b/w the 'E' and B_1. The voltage V b/w E and B_1 establishes a RB on PN J.n & the I_E is cutoff, but a small leakage current flow from B_2 to E due to

minority charge carriers. Thus, the device is said to be off state.

- With E at positive Potential

When a +ve voltage is applied at the 'E', the PN j^n will remain RB till the V_{in} is less than V_i. As the i/p voltage at E exceeds V_i, the PN j^n becomes FB. Here, Holes from 'p' supplied to n type. These holes are repelled by +ve B_2 and attracted towards B_1. This increase in no. of holes in the emitter to B_1 results in decrease of resistance of this section of the bar. Because of this, the 'Internal voltage' drop from E to B_1 is reduced, thus IE increases. As more holes are supplied, a cond^n of Saturation is reached. At Sat^n, IE is limited by the E power supply. Hence, device is now conducting is said is ON state.

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Applications :

(i) Oscillators

(ii) Trigger circuits

(iii) Saw tooth generator

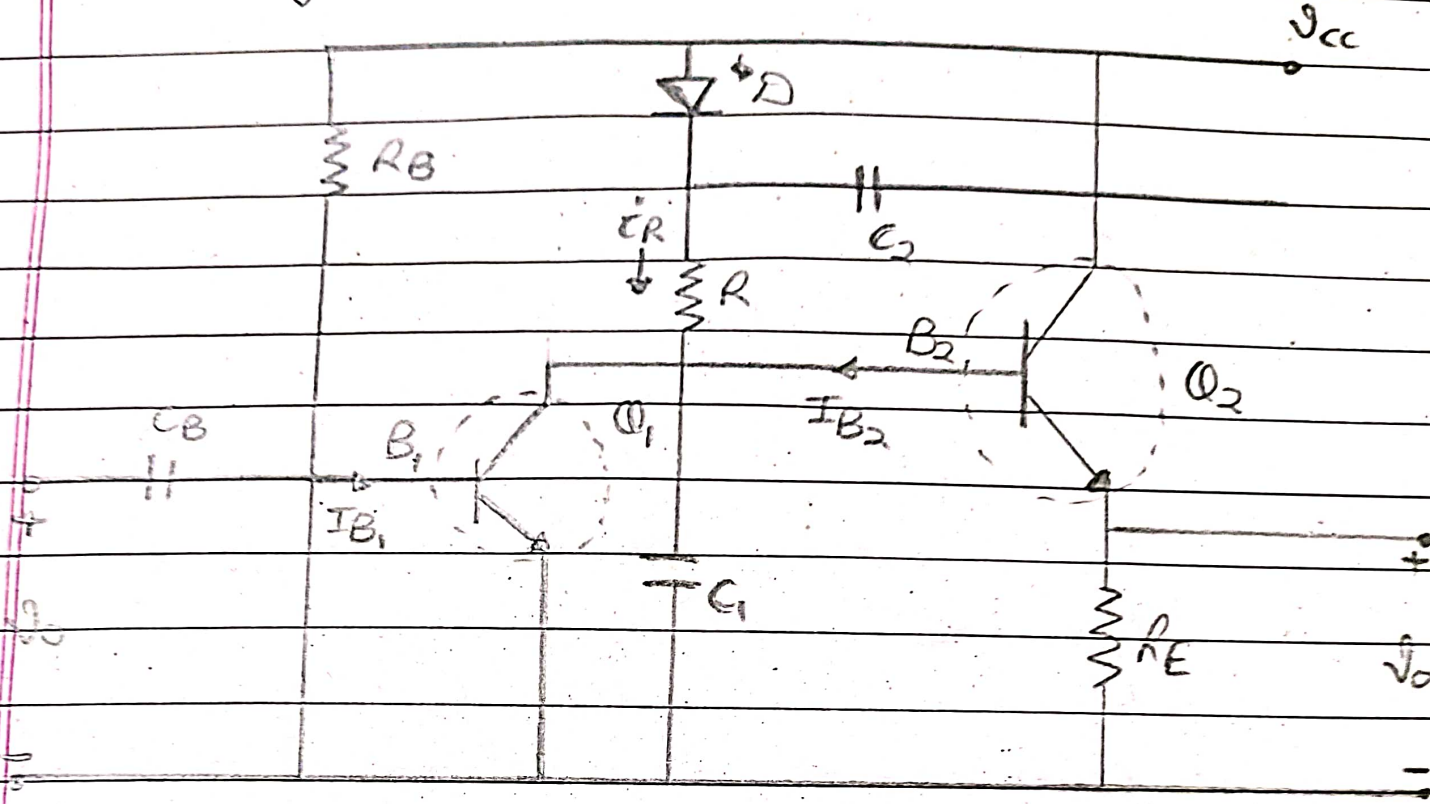
(iv) Bistable networks

(v) Pulse & voltage sensing ckts.

(vi) UJT relaxation oscillators

(vii) Over voltage detectors.

Q. Discuss Transistor Boot strap Time Base generator.



- A ckt is called "Time Base generator". if that ckt produces a linearly varying voltage or current wrt time at the o/p. Since voltage o/p provided by Bootstrap Sweep ckt also changes linearly with time, the ckt is also called Bootstrap time base generator.

Working :-

→ Before the appn of gating waveform at t = 0, as the transistor gets enough base drive from Vcc through R_B. Q_1 is ON and Q_2 is OFF.

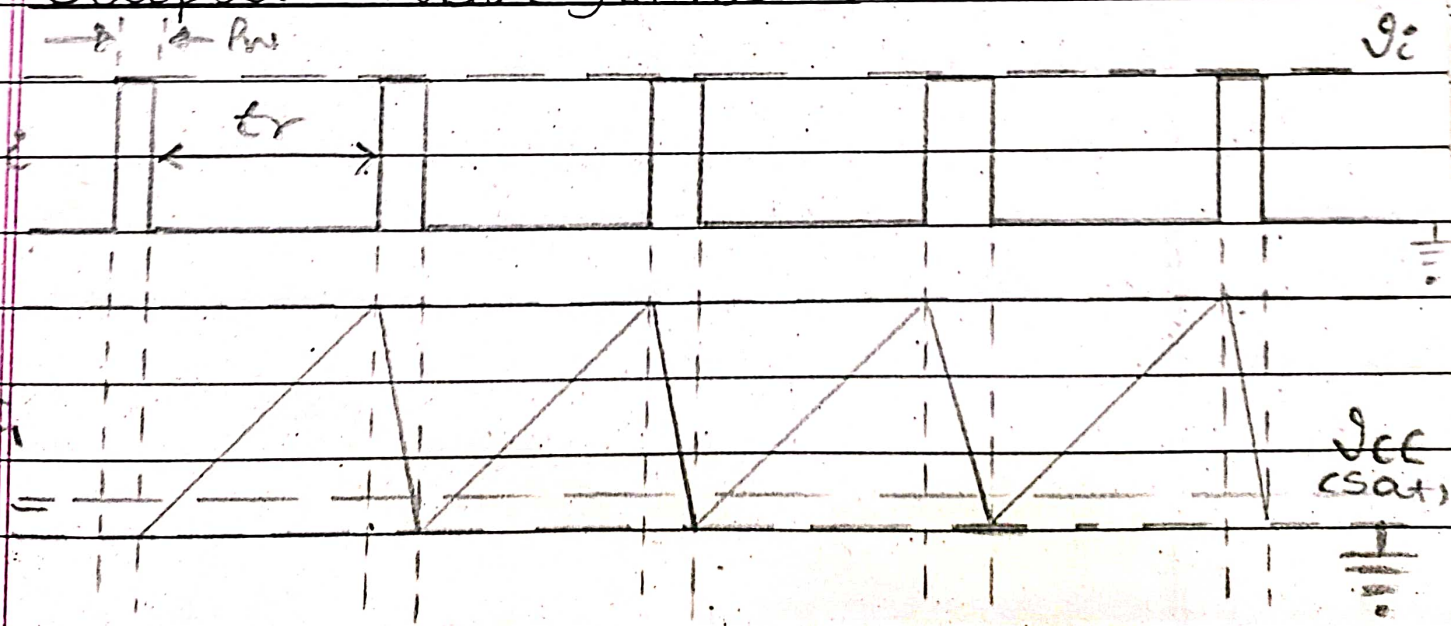
→ The 'C_2' charges to Vcc through the diode 'D'. Then a -ve trigger pulse from the gating waveform of a monostable Multivibrator is applied at a base of Q_1 which turns Q_1 OFF. The C_2 now discharges & C_1 charges through 'R'. As C_2 has large value capacitance, its voltage levels vary at a slower rate. Hence, it discharges slowly & maintains a nearly const. Value during the ramp genn at the O/p of Q_2.

→ During the ramp time, the 'D' is RB. The C_2 provides a small current I_C for C_1 to charge. As the capacitance value is high, though it provides current, it doesn't make much difference in

its charge. When Q_1 gets ON at the end of Ramp time, C_1 discharges rapidly to its initial value. This voltage appears across V_o. Consequently, the diode D gets fwd biased again & the C_2 gets a pulse of current to recover its small charge lost during the charging of C_1. Now, the ckt is ready to produce another ramp o/p.

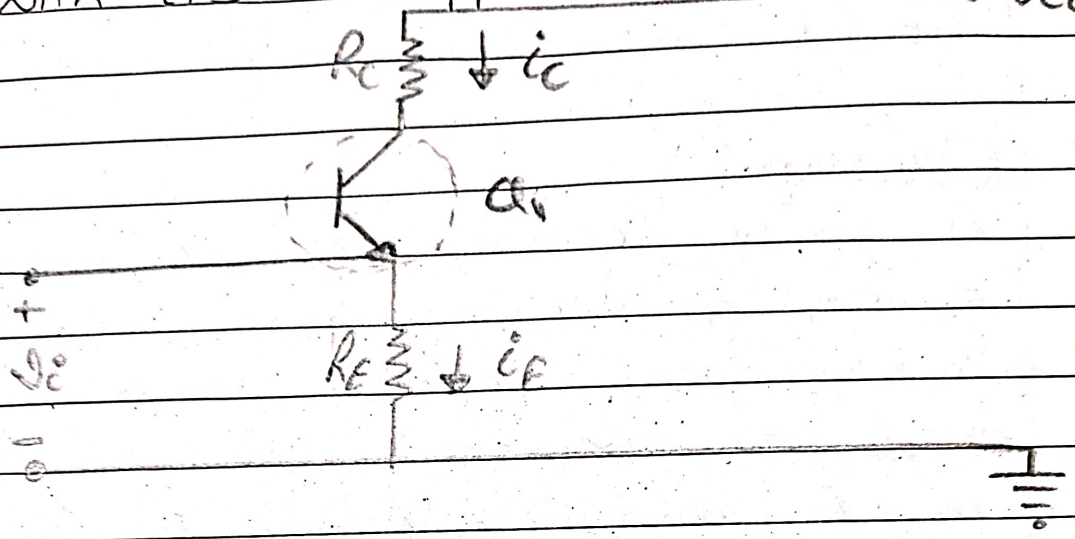
→ The C_2 which helps in providing some F/B current to the C_1 acts as a "boot strapping capacitor" that provides const. current.

- **Output Wave forms :-**



The pulse given at the i/p & voltage V_C which denotes the charging & discharging of C which contributes the o/p as shown.

Q. Discuss the working of Transistor Current Time Base Generator along with its applications.



- Working Principle:

The Vcc is applied across R. The capacitor C starts charging. An i/p signal Vi turns on the Q_1. The transistor provides a low resistance through which the capacitor gets discharged. If the Q_1 is not turned on the capacitor will charge exponentially to supply Vcc. This controlled charging & discharging of 'c' generate the sawtooth waveform.

- A time base generator that provides an o/p waveform that varies linearly with time is called as a current time base generator.

→ Working:

- A simple RC time base generator or a Ramp generator or a sweep ckt consists of a CB config. transistor or two resistors, having one in 'f' and another in "C". The Vcc is given to C of the transistor.

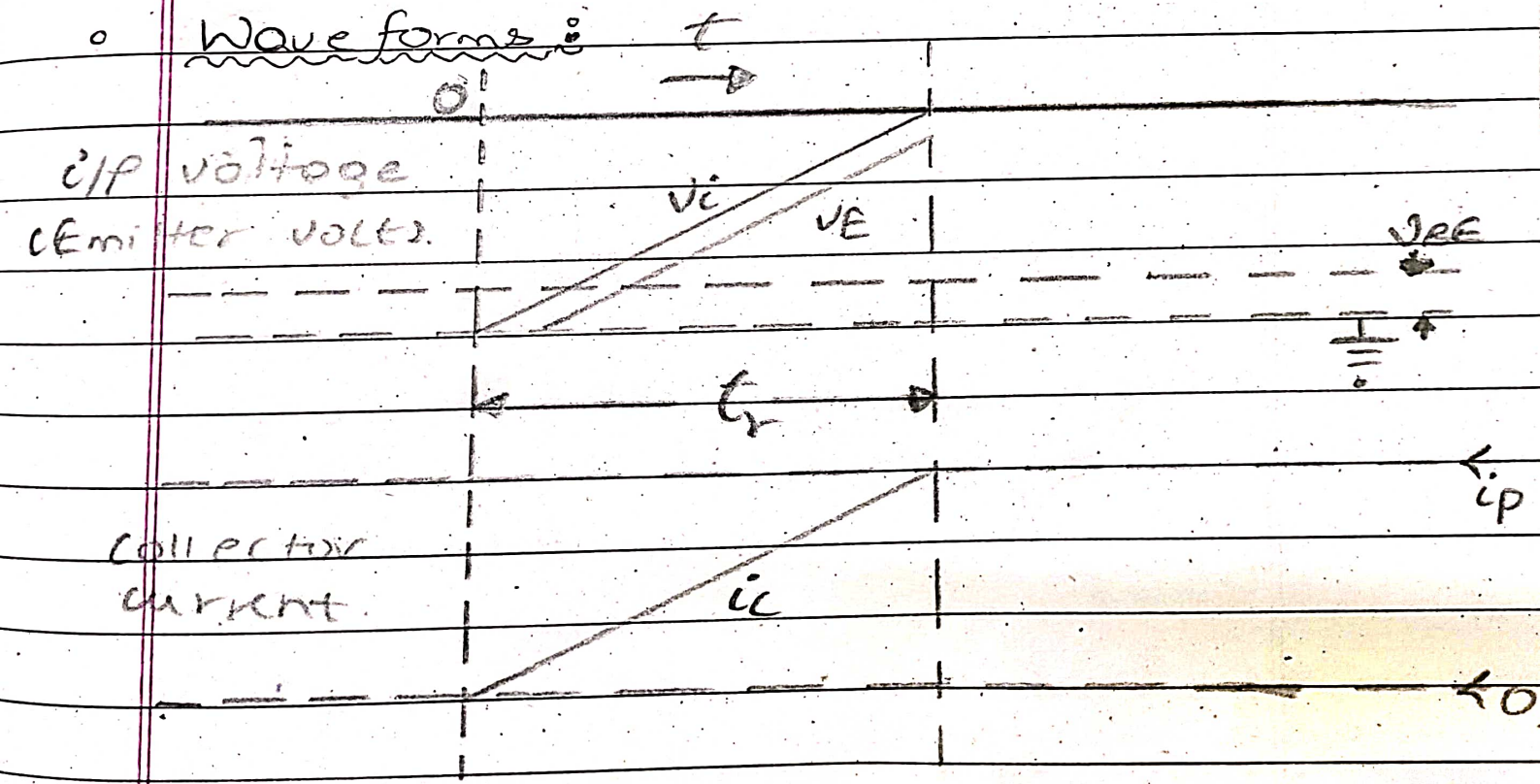
- A transistor connected in CB config. has it's Ic vary linearly with its IE. When IE is held constant, Ic also will be near constant value; except for very smaller values of collector base voltages.

- As the i/p voltage V_i is applied at the base of the Q_1, it appears at the E which produces the I_E & increases linearly as V_i increases from zero to its peak value. The I_C increases as the I_E increases, because I_C is closely equal I_E.

- The instantaneous value of load current is

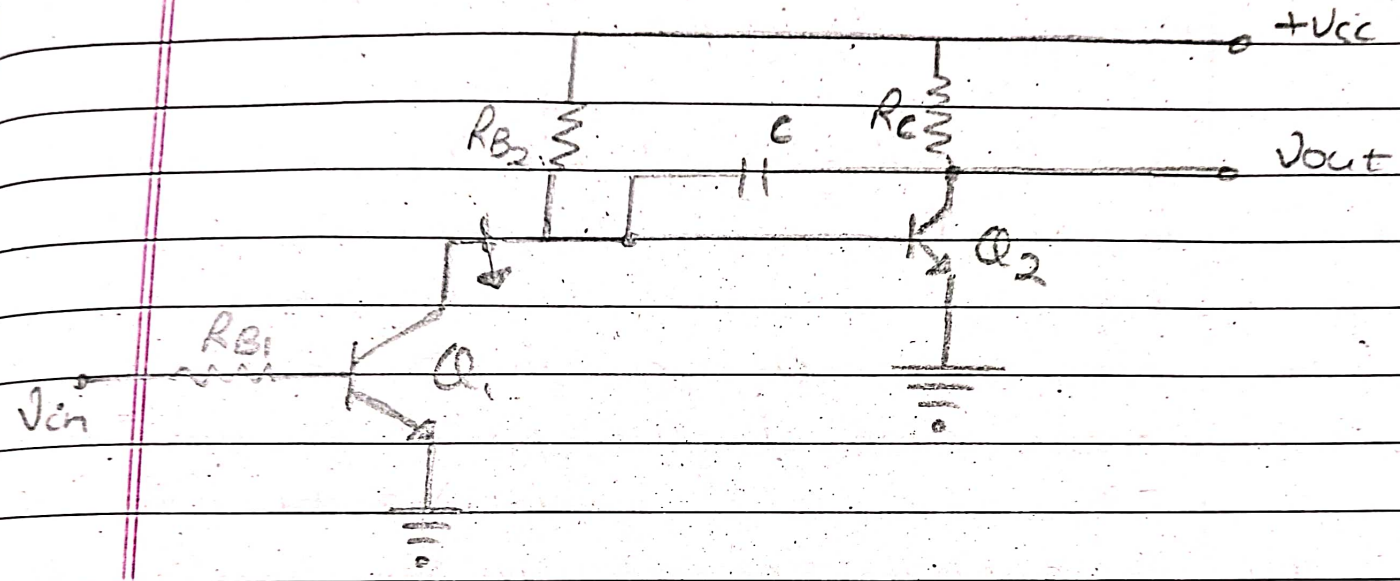
$$I_L \; I_C \approx (V_i - V_{BE}) / R_E$$

- Waveforms:

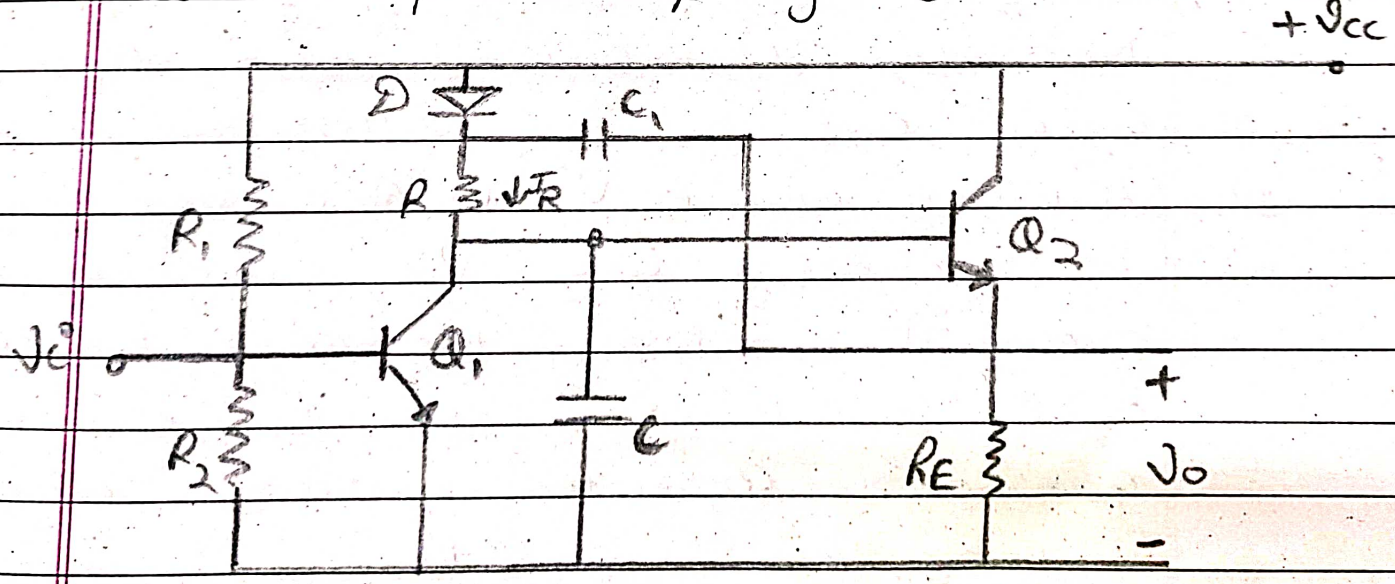


Q. Discuss the differences of working b/w miller and boot step time base generator.

- Ckt diagram of Miller sweep :



- Bootstrap sweep generator :



	Miller time base generator	Bootstrap time base generator.
(i)	The polarity of sweep voltage is negative.	(i) The polarity of sweep voltage is positive.
(ii)	The inverting amp^r is used in this circuit.	(ii) The non-inverting amp^r. is used in this ckt.
(iii)	The open ckt gain of the amp^r is $A = -\infty$	(iii) The open ckt gain of the amp^r is $A = +1$
(iv)	The linearity of sweep voltage is better than that of the bootstrap sweep ckt	(iv) The linearity of the sweep voltage is poor than that of the miller sweep ckt.
(v)	A voltage source 'V' is simulated like that 'V' is always equal to the instantaneous capacitor voltage V_c.	(v) A voltage source 'V' is suggested like that 'V' is forever equal to the immediate capacitor voltage V_c.

Q.

(a) Why linearity is important for sweep circuit.

Ans. In the context of sweep CKTs, the linearity is important because it ensures accurate & predictable operation sweep CKTs are commonly used in electronic systems for applications such as signal generation, frequency modulation & oscilloscope displays.

→ Why linearity is crucial for sweep circuits :-

1. Frequency Accuracy :-
In many sweep ckt applications, the ckt is responsible for generating a linear change in frequency over a time. This is essential in applications like frequency modulation or when gathering a linear frq sweep for testing & analysis purposes. Linearity ensures that the relation ship b/w the i/p control signal & the o/p frequency

is consistent and predictable

2. Signal Integrity: Linearity helps maintain the integrity of the signal being generated. When sweep ckt produces a linear o/p, it reduces the likehood of distortion or harmonic generation in the generated signal. This is especially important in applications where accurate & distortion-free signals are required, such as in comm.n systems

3. Precision Measurements:
In case of oscilloscopes & other test & measurement equipment, sweep ckts are used to display signals over time. Linearity is critical for accurate time base settings, allowing precise measurements of signal characteristics such as frequency, amplitude & timing.

4. System Stability :
Linearity contributes to the stability of the overall system. Non-linearities in the sweep ckt could lead to unpredictable behaviour, distortion & signal artifacts, importing the performance of the entire system.

5. Control and Calibration :
Linearity simplifies the control & calibration of sweep ckts. Engineers & technicians can more easily predict the behaviour of the ckt & calibrate it for specific applications when the relationship b/w the i/p & o/p is linear.

(b). Discuss the different Linearity improvement method.

Ans.

Methods of Linearity improvement :-

- Analog Linearisation
- Linearisation through power consumption.
- Optimum device biasing
- Linearization through FIb
  - Long/Short channel devices
  - BJT
- Low-freq? termination to improve linearity
- Out of band terminations to improve linearity
- feed forward Linearization
- Envelope signal injection techniques to improve linearity.