# Multi-Vibrator (MV)
# Lecture – 3

## TDC PART – I
## Paper - II (Group - B)
## Chapter - 3


by:

**Dr. Niraj Kumar,**

Assistant Professor (Guest Faculty)

**Department of Electronics**

**L.S. College, BRA Bihar University, Muzaffarpur.**

## (2) Transistor Monostable Multivibrator (MMV)

- The monosatale multivibrator (sometimes called a ONE-SHOT MULTIVIBRATOR) is a square or rectangular wave generator with have just one stable condition and one quasi stable condition. With no input signal (quiescent condition) one Transistor (transistor as a switch) conducts and the other Transistor (transistor as a switch) is in cutoff. A multivibrator in which one transistor is always conducting (i.e. in the ON state) and the other is non-conducting (i.e. in the OFF state) is called a monostable multivibrator.

- The operation of the monostable multivibrator is relatively simple. The input is triggered with a pulse of voltage. The output changes from one voltage level to a different voltage level. The output remains at this new voltage level for a definite period of time **determined by RC circuit component. After this period of time, the circuit** automatically return to its initial original voltage level and remains **there** until another trigger pulse is applied to the input.

- Monostable Multivibrator is also called a **Single-Shot or Single Swing or a One-Shot Multivibrator.** Other names are: **Delay Multivibrator and Univibrator.** The monostable or **one-shot multivibrator** has

  **(i)** one **absolutely stable** (stand-by) state and
  **(ii)** one **quasi-stable state** i.e. half-stable state

- The application of **External input triggers pulse** the circuit can be **switched** from **Stable State** to the **Quasi-Stable state**, in which it **remains for a time period determined by RC circuit component.** After this period of time, the circuit **returns to its initial Stable state. This process is repeated** upon the **application of each trigger pulse.** Since the monostable multivibrator **produces a single output pulse for each input trigger pulse,** it is generally called One-Shot multivibrator. **It has one energy- storing element i.e. One Capacitor.**

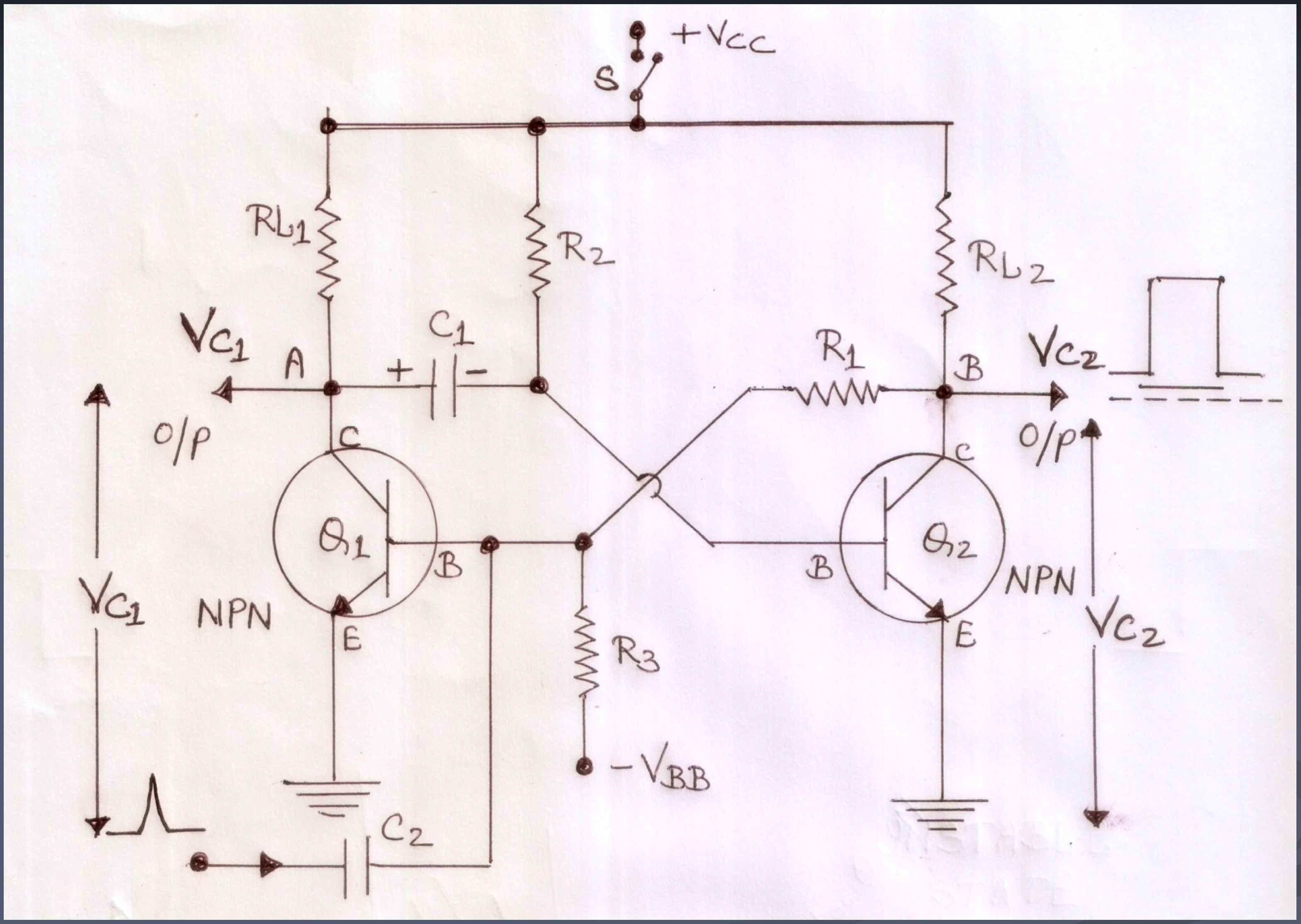
- A monostable (mono means single or one) multivibrator has only **one state stable** and **one quasi-stable state** i.e. **half-stable state** In other words, if **one transistor** is **conducting (ON)** and the other one is **non-conducting (cut-off), the circuit will remain in this position.** It is only with the **application of external input triggers pulse** that the circuit will interchange the states. The application of **External input triggers pulse** the circuit can be **switched from Stable State** to the **Quasi-Stable state,** in which it **remains in this position** for a **time period determined by RC circuit component.**

- **After this period of time, the circuit will automatically switch back to the original stable state and remains there until another input triggers pulse is applied.** Thus a monostable multivibrator cannot generate square waves of its own like an astable multivibrator. **It supplies a single output pulse of a desired duration for every input trigger pulse.** Only external pulse will cause it to generate the square wave. The monostable multivibrator actually takes series of input triggers and converts them to **uniform square pulses,** as shown in **figure (16).** All of the **square output pulses** are of the **same amplitude and time duration.**

# Transistor MMV Circuit Details

- **Fig. (12)** Shows the circuit diagram of a Transistor Monostable Multivibrator in **slide 9.** Here, **Collector terminal of transistor Q1** is coupled to **transistor Q2** base through **capacitor C1** as in an **AMV** but the other coupling is different. It consists of **two similar NPN transistors Q1** and **Q2** with **equal collector loads i.e. RL1 = RL2.** The values of negative supply **-VBB** and **resistor R3** are such as to **reverse bias NPN transistor Q1** and **keep it at cut off.** The **collector supply +VCC and resistor R2 forward bias NPN transistor Q2 and keep it at saturation.** The **External input trigger pulse** is given through **Capacitor C2 to the base terminal of NPN transistor Q1.**

- To obtain the **square wave output** again it can be taken from **Collector terminal of NPN transistor Q1 at Point A or NPN transistor Q2 at Point B.** In the MMV circuit diagram the Function of resistors RL1 and RL2 is to limit collector current of both transistors Q1 and Q2. Resistors R1 & R2 will provide base current for transistors Q1 & Q2 respectively during ON condition. In this multivibrator, a single narrow input positive trigger pulse produces a single **square wave** or **rectangular wave pulse** whose **amplitude, pulse width** and **wave shape** depend upon the values of **circuit components (RC)** rather than upon the **trigger pulse.**




- **Fig. (12)** shows the circuit diagram of a Transistor Monostable Multivibrator.

# MMV Initial Condition (STABLE STATE)

- In the absence of a triggering pulse at **capacitor C2** and with **switch S** closed,

  (1) **+VCC** provides **reverse bias** for **C/B junctions of Q1 and Q2** but **forward-bias** for **E/B junction of Q2 only.** Hence, **Q2 get into saturation** and **conducts (ON State).**

  (2) **Negative –VBB supply** and **resistor R3 reverse bias Q1** and **keep it cut off.**

  (3) **Capacitor C1 charges** to nearly **Positive +VCC** through **Load resistor RL1** to **ground** by the **low-resistance path** provided by **saturated Q2.**

- As seen, the initial stable state is represented by

  (i) Q2 conducting (ON State) at saturation and
  (ii) Q1 cut-off (OFF State).

- **Fig (13) Shown below MMV initial stable condition.**

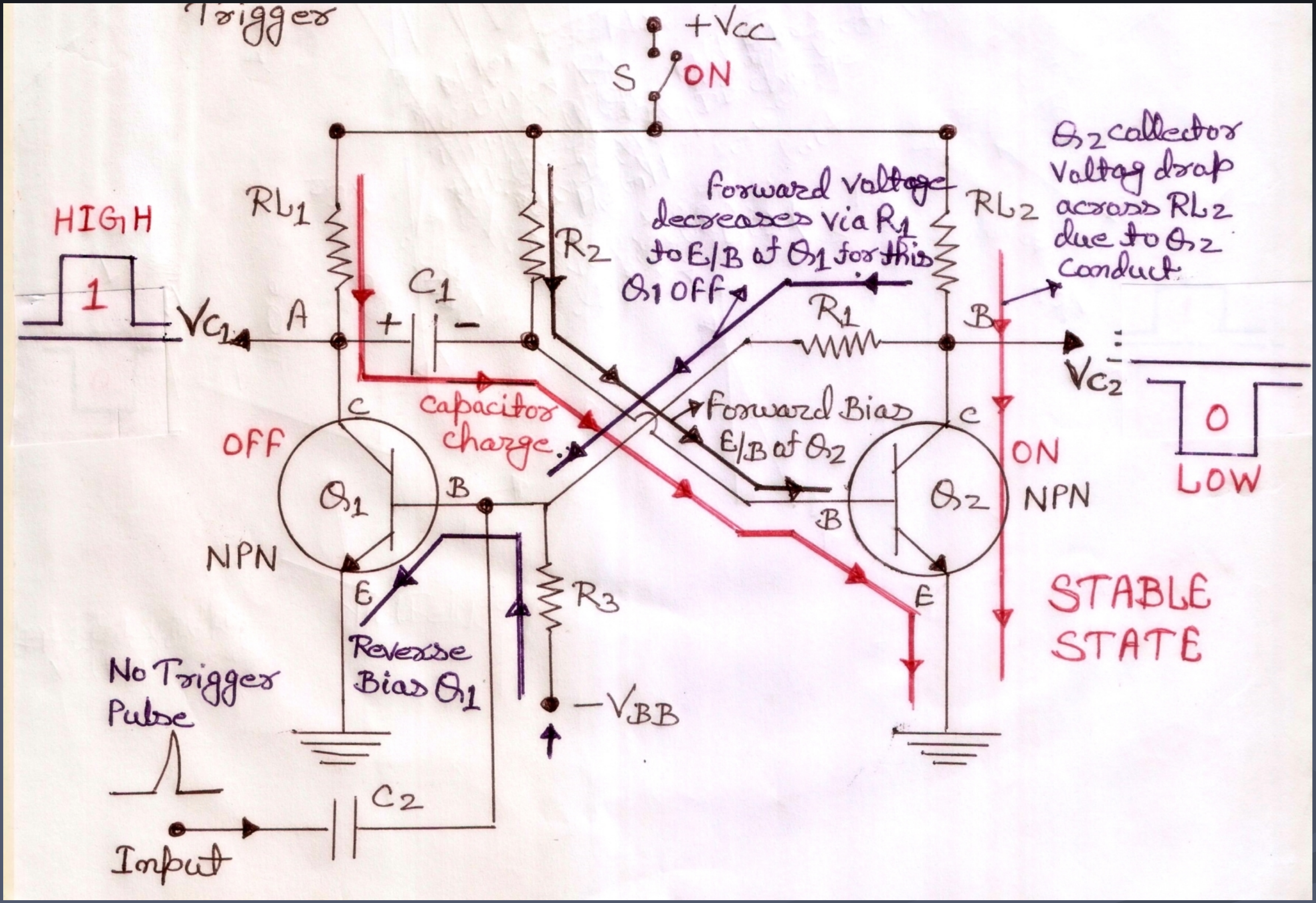



**Fig (13)** Shown MMV Initial Condition when No Trigger Pulse applied (STABLE STATE)

# When Trigger Pulse is Applied (UNSTABLE STATE)

- When a External **Positive trigger pulse** is applied to **NPN transistor Q1** through **capacitor C2, MMV** will **switch** to its opposite unstable state where **transistor Q2** is **cut-off (OFF**) and **Q1 conducts (ON)** at saturation. The chain of circuit actions is as under :-

(1) If **positive trigger pulse** is of **sufficient amplitude**, it will over-ride the **reverse bias of the E/B junction** of **transistor Q1** and give it a **forward bias**. Hence, **transistor Q1 will start conducting (ON).**

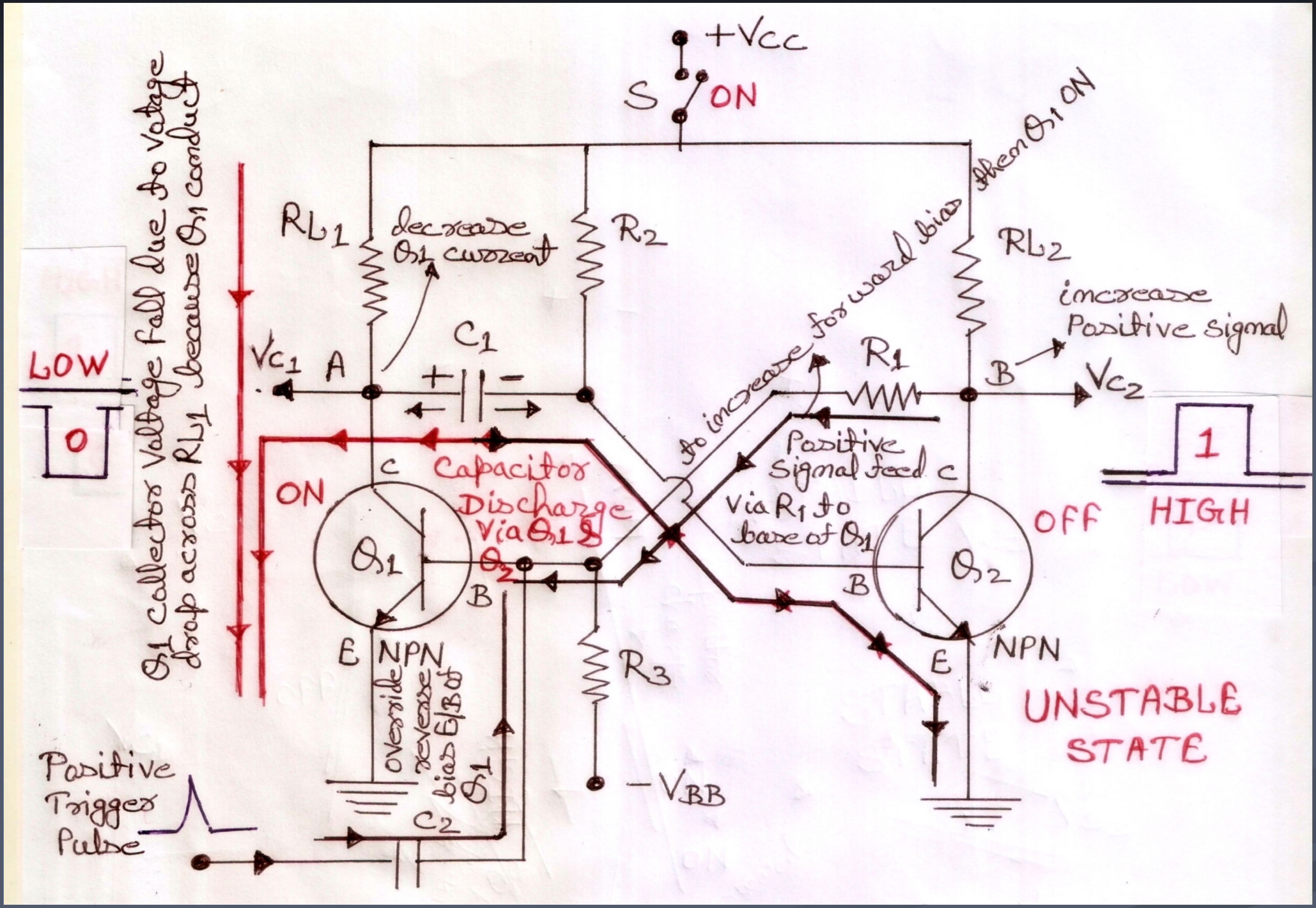
(2) As **Q1 conducts**, its collector voltage falls due to voltage drop across **RL1**. It means that potential of **point A falls (negative-going signal).** This **negative-going voltage is fed to Q2 via C1 where it decreases its forward bias.**

**(3)** As **collector current of Q1 starts decreasing,** potential of **point B increases (positive-going signal) due to lesser drop over RL2.** Soon, **Q2 comes out of conduction.**

**(4)** The **positive-going signal** at **Point B** is **fed via R1** to the **base of Q1** where it **increases its forward bias further.** As **Q1 conducts** more, potential of **point A approaches 0 V.**

**(5)** This **action is cumulative** and **ends with Q1 conducting (ON) at saturation** and **Q2 cut-off.**

**Fig (14)** Shown below MMV circuit diagram when Positive Trigger Pulse is Applied (UNSTABLE STATE)



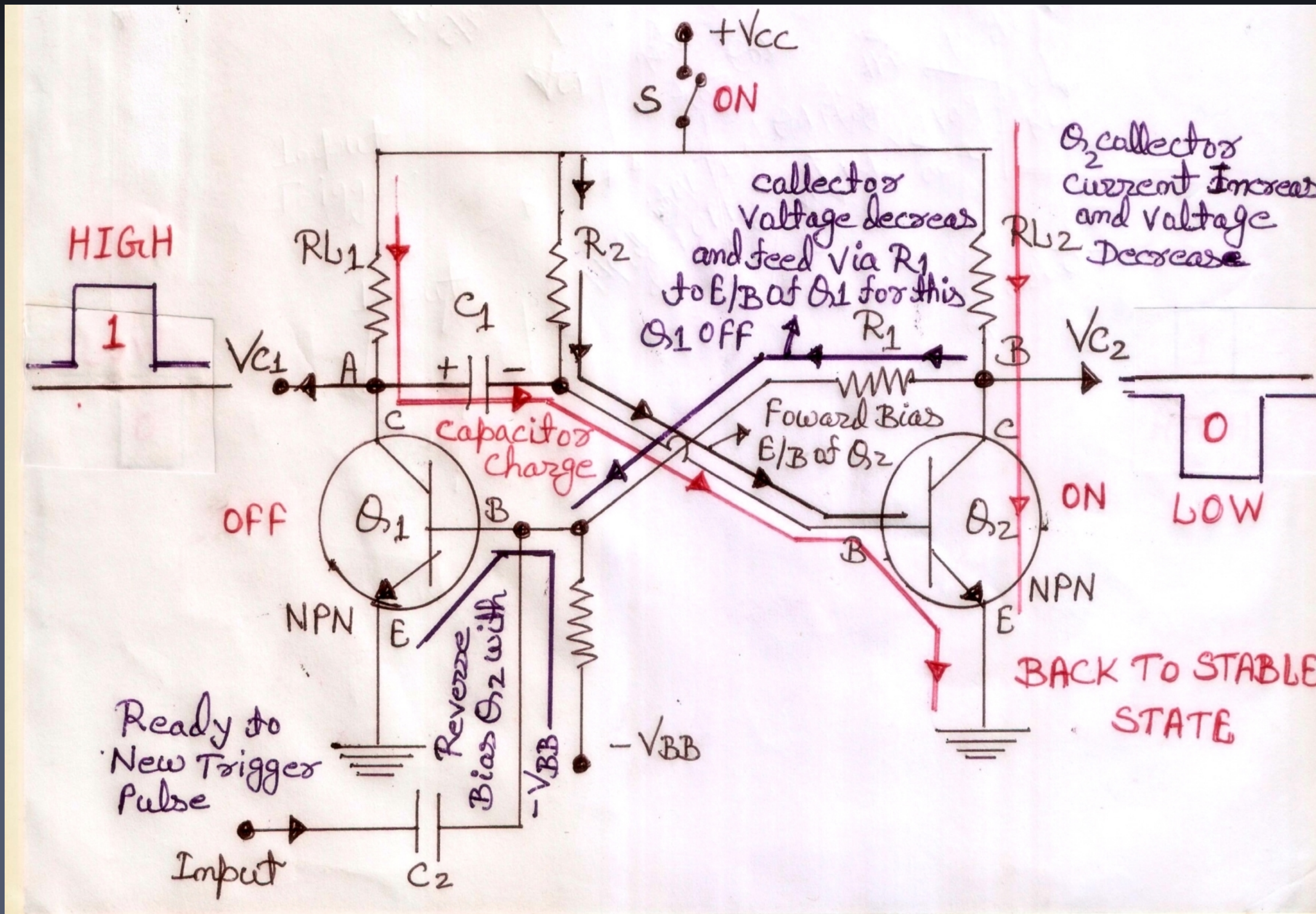

- **Fig (14)** Shown MMV circuit diagram when Positive Trigger Pulse is applied (UNSTABLE STATE)

## Return to Initial Stable State (BACK TO STABLE STATE)

**(1)** As **point A** is at **almost 0 V, C1 starts to discharge** through **saturated Q1 to ground.**

**(2)** As **C1 discharges**, the **negative potential** at the **base of Q2** is **decreased**. As **C1 discharges further, Q2 is pulled out of cut-off.**

**(3)** As **Q2 conducts further**, a **negative-going signal** from **point B** via **R1** drives **Q1** into **cut-off**. Hence, the circuit reverts to its original state with **Q2 conducting** at **saturation** and **Q1 cut-off. It remains in this state till another trigger pulse comes along when the entire cycle repeats itself.** It is shown in **Fig. (15),** when MMV back to **initial stable state**.




- **Fig (15)** Shown MMV circuit diagram when MMV return to Initial Stable State (BACK TO STABLE STATE)

- The **output** is taken from the **point A of collector of Q2** though it can also be taken from **point A of Q1** as shown in **Fig (12) and (15).** The **width of this pulse is determined by the time constant of R2C1.** Since this **MV produces one output pulse for every input trigger pulse it receives, it is called mono or one-shot multivibrator.**

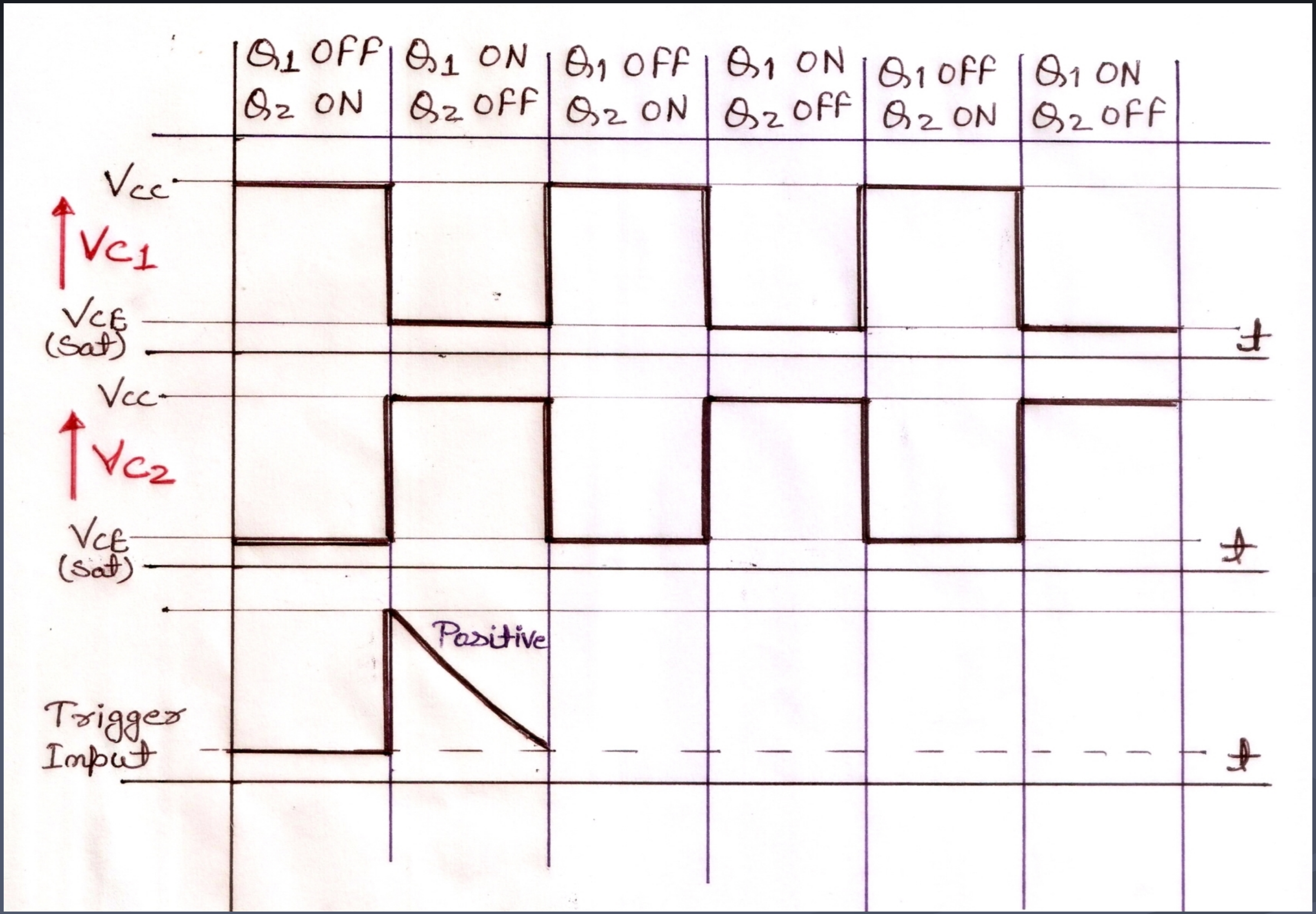
# MMV Output Waveforms

- The output waveforms at the **collectors of Q1** and **Q2** along with the **trigger input given at the base of Q1** are shown in the following **fig. (16)** below.

- The width of this output pulse depends upon the RC time constant. Hence it depends on the values of R2C1. **The width or duration of the pulse is given by**

$$T = 0.69\ R2C1$$

- **It is also known as the one-shot period**. The trigger input given will be of very short duration, just to initiate the action. This triggers the circuit to change its state from Stable state to Quasi-stable or Meta-stable or Semi-stable state, in which the circuit remains for a short duration. There will be one output pulse for one trigger pulse.




- **Fig (16)** Shown MMV output square wave forms at the both transistor Q1 and Q2 output terminal voltage **VC1** and **VC2** along with Positive input Trigger Pulse.

# MMV Advantages

- The advantages of Monostable Multivibrator are as follows −

  **(1)** One trigger pulse is enough.

  **(2)** Circuit design is simple

  **(3)** Inexpensive

# MMV Disadvantages

(1) The major drawback of using a monostable multivibrator is that the time between the applications of trigger pulse T has to be greater than the RC time constant of the circuit.

# MMV Usage

**(1)** The falling part of the output pulse from MMV is often used to trigger another pulse generator circuit thus producing a pulse delayed by a time T with respect to the input pulse.

**(2)** MMV is used for regenerating old and worn out pulses. Various pulses used in computers and telecommunication systems become somewhat distorted during use. An MMV can be used to generate new, clean and sharp pulses from these distorted and used ones.

**(3)** MMV is used for pulse stretching.

**(4)** It is used in computer logic systems and communication navigation equipment.

**(5)** Monostable Multivibrators are used in television circuits and control system circuits.

**to be continued ....................**