SNS COLLEGE OF TECHNOLOGY

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Department of Biomedical Engineering

Course Name: 23BMB101-Electron Devices and Circuits

I Year : II Semester

Unit IV –Power Amplifiers & Switching Circuits

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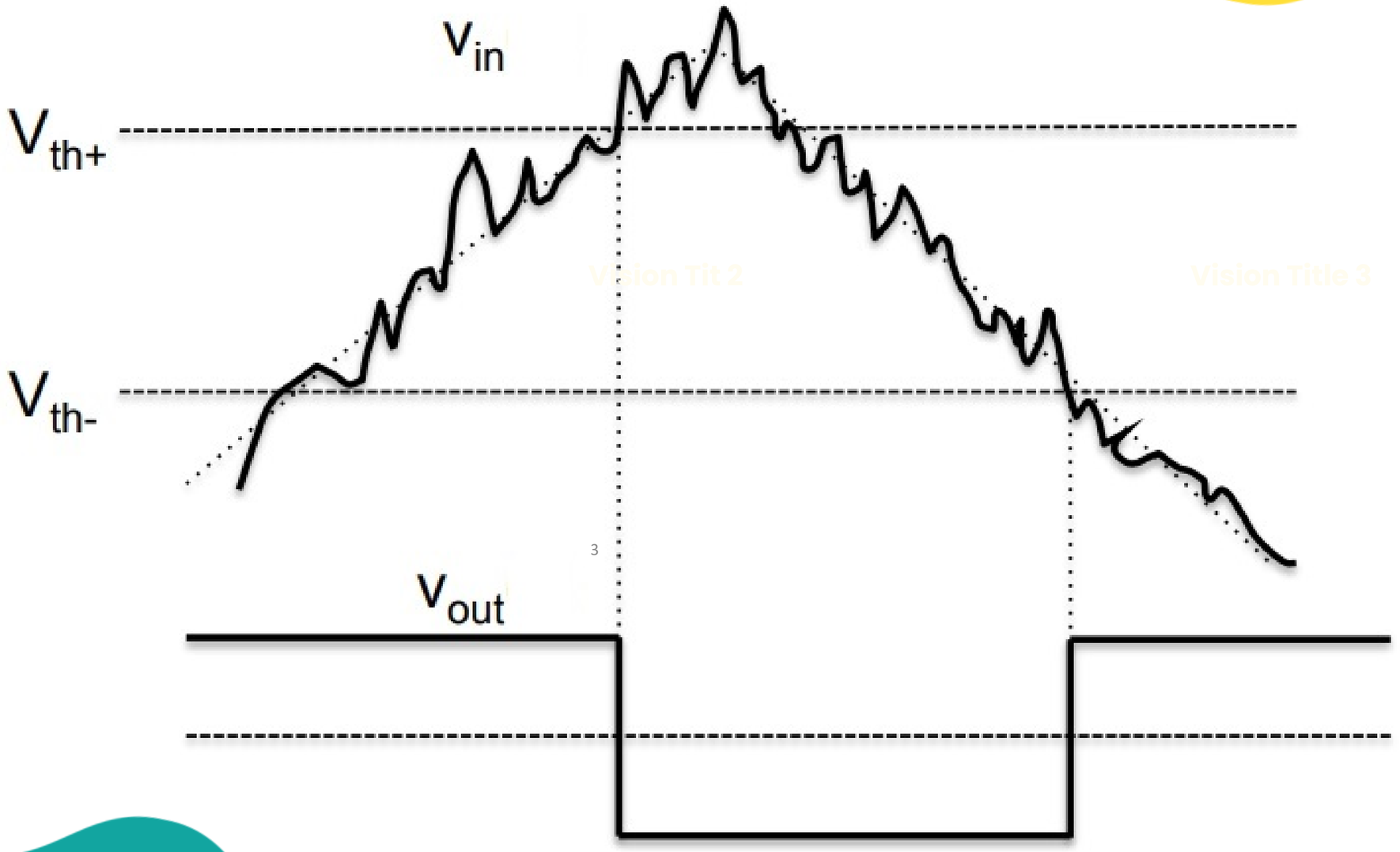
Topic : Schmitt Trigger

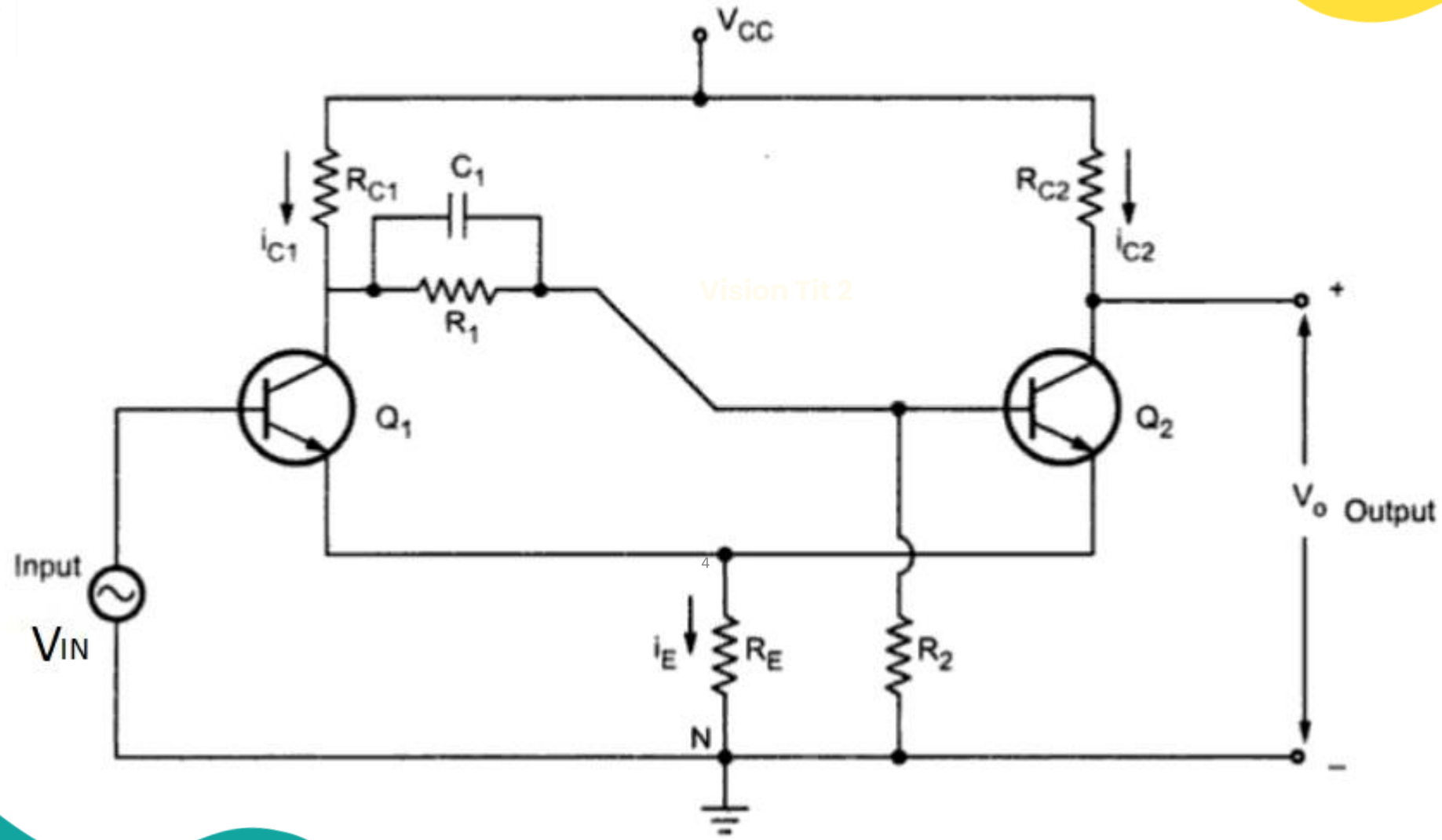
INTRODUCTION

- Schmitt Trigger is an electronic circuit that adds hysteresis to the input-output transition threshold with the help of positive feedback.
- Hysteresis here means it provides two different threshold voltage levels for rising and falling edge.
- Essentially, a Schmitt Trigger is a Bi-stable Multivibrator and its output remains in either of the stable states indefinitely. For the output to change from one stable state to other, the input signal must change (or trigger) appropriately.
- This Bistable operation of the Schmitt Trigger requires an amplifier with positive feedback (or regenerative feedback) with a loop gain greater than one. Hence, Schmitt Trigger is also known as Regenerative Comparator.

Schmitt Trigger



Construction of Schmitt Trigger

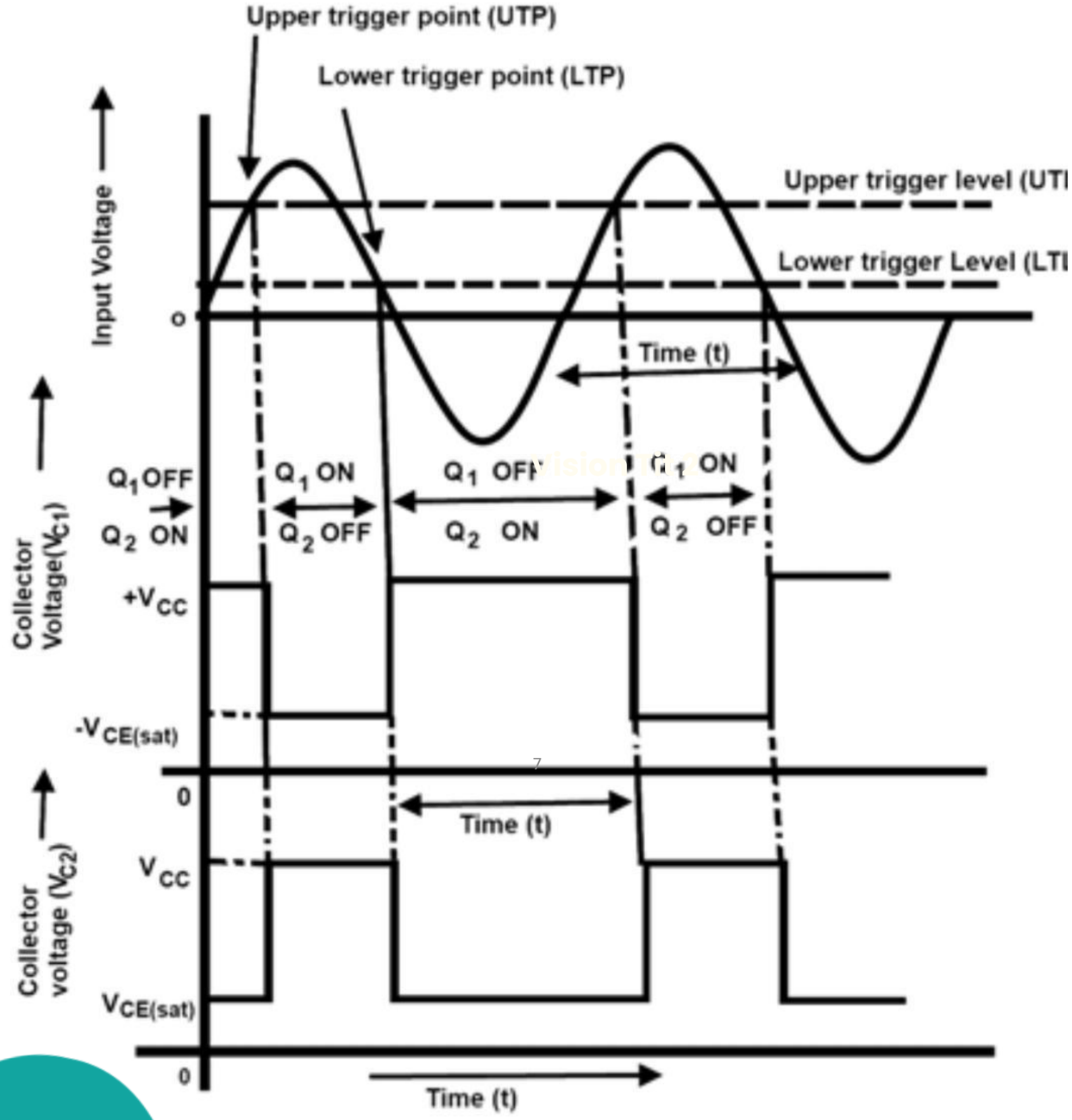


Operation of Schmitt Trigger

- When V_{IN} is zero, Q1 is cut-off and Q2 is in saturation. As a result, the output voltage V_O is LOW. If $V_{CE(SAT)}$ is assumed to be 0, then the voltage across R_E is given by:
- $(V_{CC} * R_E) / (R_E + R_{C2})$
- This voltage is also the emitter voltage of Q1. So, for Q1 to conduct, the input voltage V_{IN} must greater than sum of the emitter voltage and 0.7 V i.e.
- $V_{IN} = [(V_{CC} * R_E) / (R_E + R_{C2})] + 0.7$
- When the VIN is greater than this voltage, Q1 starts conducting and Q2 is cut-off due to regenerative action. As a result, the output V_O goes HIGH. Now the voltage across the R_E changes to a new value and is given by:
- $(V_{CC} * R_E) / (R_E + R_{C1})$

Operation of Schmitt Trigger

- Transistor Q1 will conduct as long as the input voltage V_{IN} is greater than or equal to the following:
- $$V_{IN} = [(V_{CC} * R_E) / (R_E + R_{C1})] + 0.7$$
- If V_{IN} falls below this value, then Q1 comes out of saturation and the rest of the circuit operates due to regenerative action of Q1 going to cut-off and Q2 to saturation.


Upper trigger point (UTP)
Lower trigger point (LTP)
Upper trigger level (UTI
Lower trigger Level (LTI
Input Voltage
0
Time (t)
Q1 OFF
Q2 ON
Q1 ON
Q2 OFF
Q1 OFF
Q2 ON
Q1 ON
Q2 OFF
Collector Voltage(VC1)
+VCC
-VCE(sat)
0
Time (t)
Collector voltage (VC2)
VCC
VCE(sat)
0
Time (t)