



The Islamic University of Gaza

Faculty of Engineering

Department of Computer Engineering

Digital Electronics Lab

[LAB 06]

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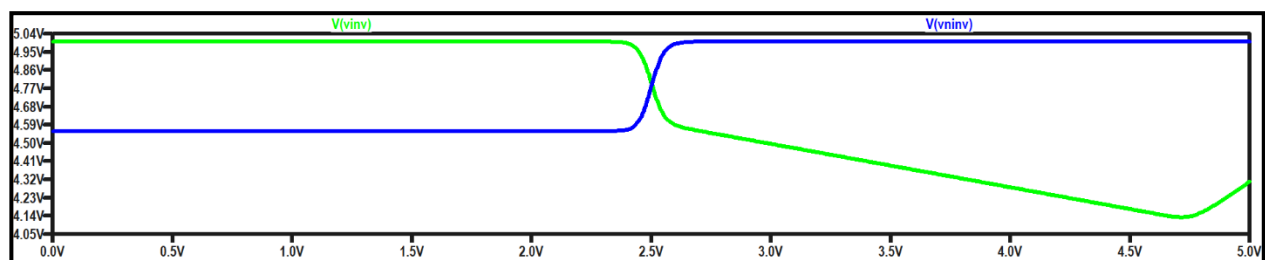
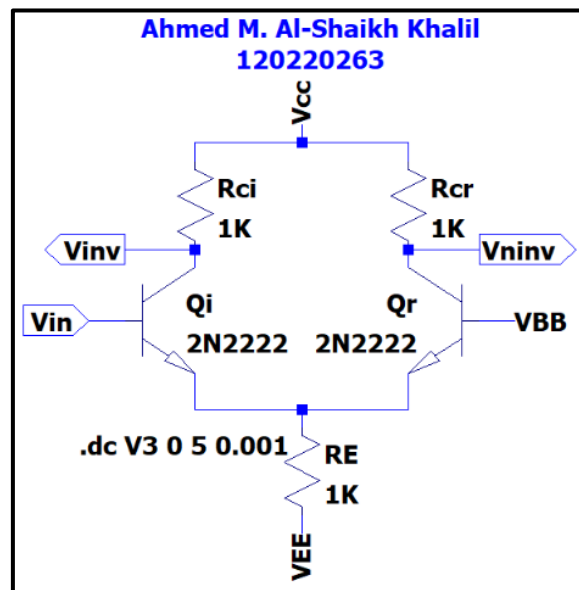
Objectives

To be familiar with the operation of ECL .

To determine the VTC of the Inverter and OR/NOR Gates

❖ Part (1): Basic ECL inverter:

A. Using LTspice find the **VTC** of the circuit shown in **Figure (6-2)**, use DC-Sweep and **Vin (0-5V)** then graph **VINV** and **VNINV** on the same graph, attach your schematic and the result.

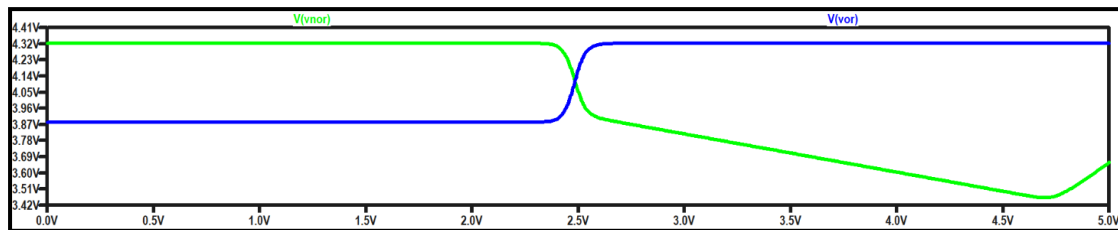
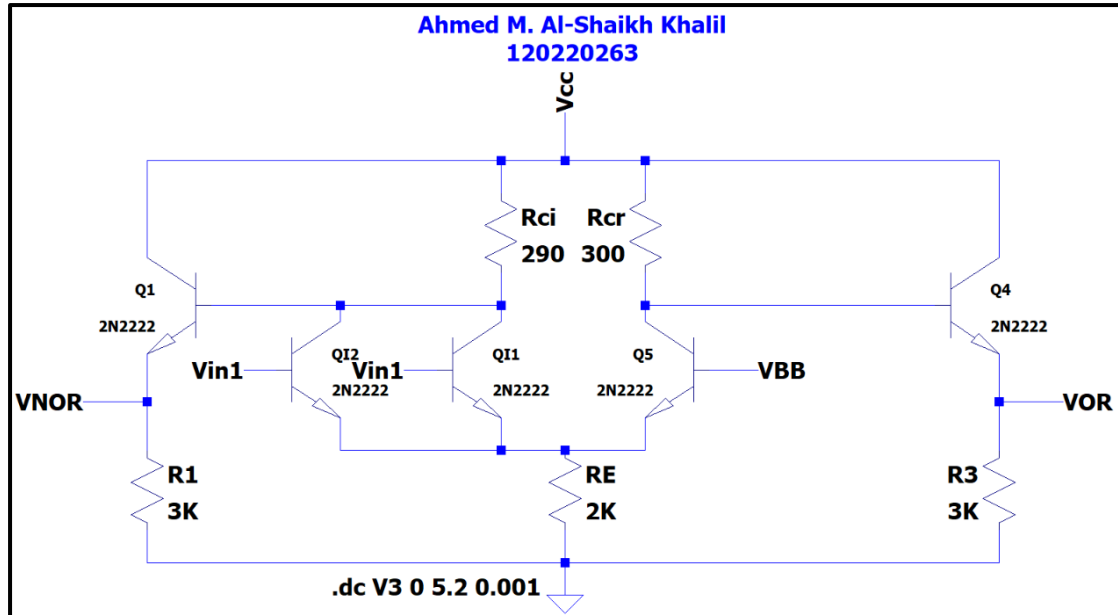


B. Determine the following:

V_{il}	2.3939394V
V_{ih}	2.6501377V
V_{ol}	3.5617243V
V_{oh}	5V
V_s	3.4300275V

❖ Part (2): Second Configuration of NOR/OR Gate:

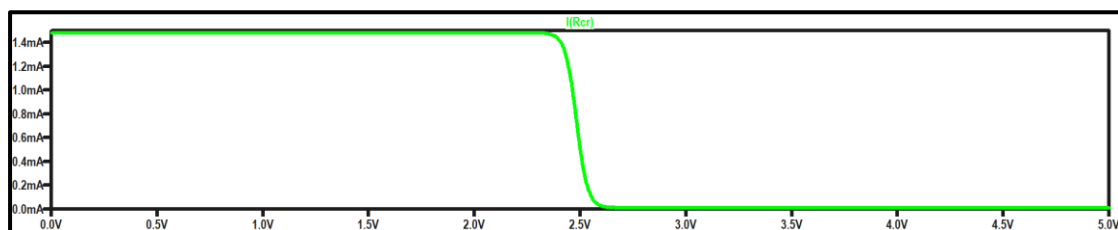
A. Using LTspice find the VTC of the circuit shown in Figure (6-4), use DC-Sweep and Vin (0-5.2V) then graph VOR and VNOR on the same graph, attach your schematic and the result.



B. Determine the following:

V_{il}	2.3939394V
V_{ih}	2.6115702V
V_{ol}	3.882662V
V_{oh}	4.3211136V
V_s	4.7107438V

C. Draw I_{Rcr} in another plot pane and attach the result.



Bonus Question: What happens to the ECL circuit when the input voltage reaches the switching threshold (V_s), and how can we observe this change in LTspice?

Answer: When the input voltage (V_{in}) equals the switching threshold (V_s), the circuit reaches its **crossover point** where the following changes happen:

- **Equal Current Splitting:** The current passing through the shared emitter resistor (R_E) divides equally between both sides of the circuit. This means the input transistors and the reference transistor carry the same amount of current.
- **Output Voltage Intersection:** Because the currents are equal, the voltage drop across the collector resistors becomes identical. As a result, the two output curves (V_{OR} and V_{NOR}) intersect (cross each other) at this exact point.
- **Maximum Gain:** At this specific voltage, the circuit is highly sensitive, and the voltage gain reaches its highest possible peak.