1: What is an IC& Why are ICs more reliable than discrete circuits?). [2 marks]

ICs are more reliable because of elimination of soldered joints and need for fewer interconnections.

2: Write short notes about IC structure & its Classification (technology, Type, Size). [1 marks]

An integrated circuit (IC) is one in which all active and passive components such as transistor, diodes; resistors, capacitors etc. are automatically part of a small semiconductor chip. ICs are more reliable because of elimination of soldered joints and need for fewer interconnections.

  IC Classification

☐ Circuit technology (BJT, BiCMOS, NMOS, CMOS)

☐ Design style (Standard cell, Gate Array, Full Custom, FPGA)

☐ Design Type (Analog, Digital, or Mixed-Signal)
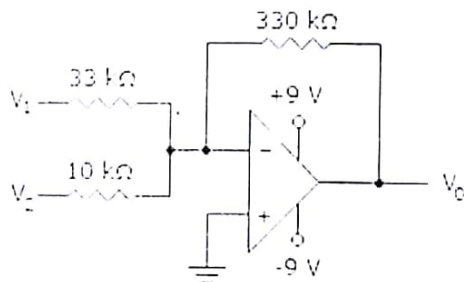
☐ Circuit Size (SSI, MSI, LSI, VLSI, ULSI, GSI)

3: What is the basic function of TTL gate?1 MARK

The basic function of TTL gate is NAND function. It is the most popular logic family.

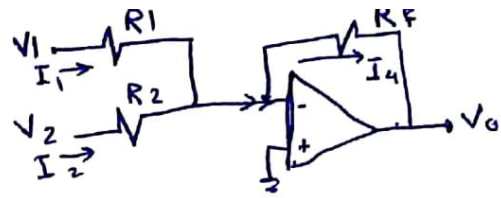4: **How many** op-amps are required to implement this equation VO = V1? **Explain**? [2marks]

One op-amp

5: Calculate the output voltage if V1 = –0.2 V and V2 = 0 V.[4marks]

$$V_0 = -R_f \left(\frac{V_1}{R_1} + \frac{V_2}{R_2} \right)$$

$$= -330 \left(\frac{-0.2}{33} + \frac{0}{10} \right)$$

3: Analysis and Design the Digital Integrated Circuit
Design Procedure

1. Specification
   - Write a specification for the circuit if one is not already available

2. Formulation
   - Derive a truth table or initial Boolean equations that define the required relationships between the inputs and outputs, if not in the specification

Answer: Option A

7: Transistor–transistor logic (TTL) is a class of digital circuits built from

a) Transistors only

b) Bipolar junction transistors (BJT)

c) Resistors

d) Bipolar junction transistors (BJT) and resistors

Answer: d

8: In DTL logic gating function is performed by

a) Diode

b) Transistor

c) Register

d) Capacitor

Answer: a

9: In DTL logic gating function is performed by

a) Diode

b) Transistor

c) Register

d) Capacitor

Answer: a

10. To increase fan-out of the gate in DTL

a) An additional capacitor may be used

b) An additional resister may be used

c) An additional transistor and diode may be used

d) None of the Mentioned

Answer: c

Explanation: To increase fan-out of the gate in DTL, an additional transistor and diode may be used. Here, the fan out means the number of maximum output.

Question (2): Choose the correct answer for the following [5 marks]

1: In a TTL circuit, if an excessive number of load gate inputs are connected, _____.

A. $V_{OH(min)}$ drops below V_{OH}

B. V_{OH} drops below $V_{OH(min)}$

C. V_{OH} exceeds $V_{OH(min)}$

D. V_{OH} and $V_{OH(min)}$ are unaffected

Answer: Option B

2: The greater the propagation delay, the _____.

A. lower the maximum frequency

B. higher the maximum frequency

C. maximum frequency is unaffected

D. minimum frequency is unaffected

Answer: Option A

3: Which equation is correct?

A. $V_{NL} = V_{IL(max)} + V_{OL(max)}$

B. $V_{NH} = V_{OH(min)} + V_{IH(min)}$

C. $V_{NL} = V_{OH(min)} - V_{IH(min)}$

D. $V_{NH} = V_{OH(min)} - V_{IH(min)}$

Answer: Option D

4: ECL IC technology is faster than TTL technology.

A. True

B. False

Answer: Option A

5: CMOS is a more dominant IC technology than TTL.

A. True

B. False

Answer: Option A

6: The greater the propagation delay, the higher the maximum frequency.

A. True

B. False

Answer: Option B

6: There are four different logic level ranges for TTL and CMOS: V_{IL}, V_{IH}, V_{OL}, and V_{OH}.
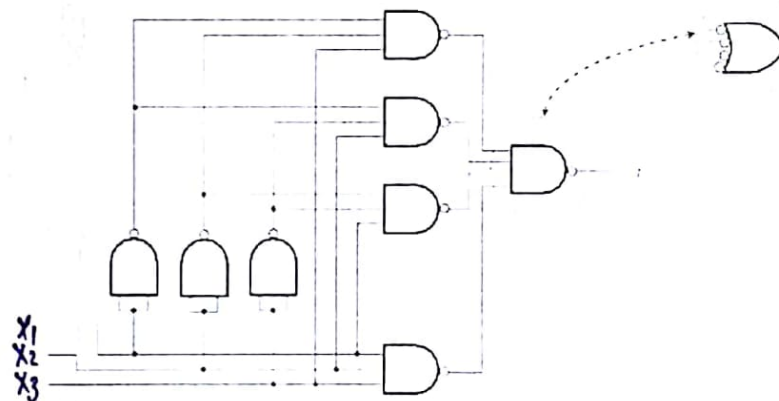
A. True

B. False

3. Optimization
- Apply 2-level and multiple-level optimization
- Draw a logic diagram or provide a netlist for the resulting circuit using ANDs, ORs, and inverters

4. Technology Mapping
- Map the logic diagram or netlist to the implementation technology selected

Solution

5. Verification
- Verify the correctness of the final design

NAND

Apply