Basic Gates (Slip-1)

HSC Board Questions Slip (Study of logic gates)

You are given ICs _____, _____, _____.

a) Identify them and draw their pin configurations. Write their typical specifications. **(5)**

b) Draw the circuit diagram for testing the logic gates. **(5)**

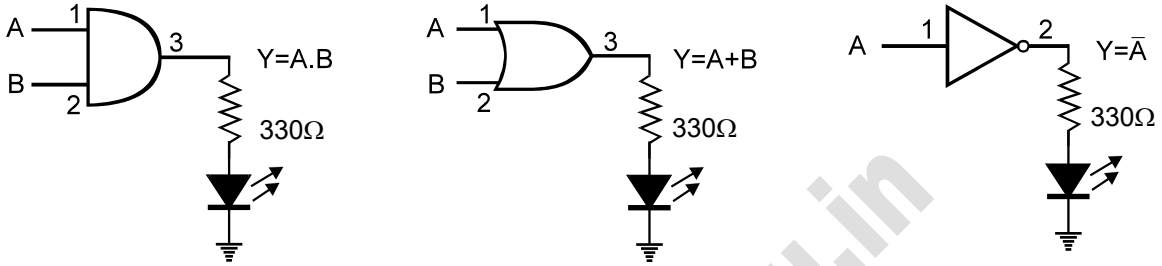
c) Connect the circuit and get it checked by the examiner. **(5)**

d) Determine the phase difference between two signals by calculations. **(5)**

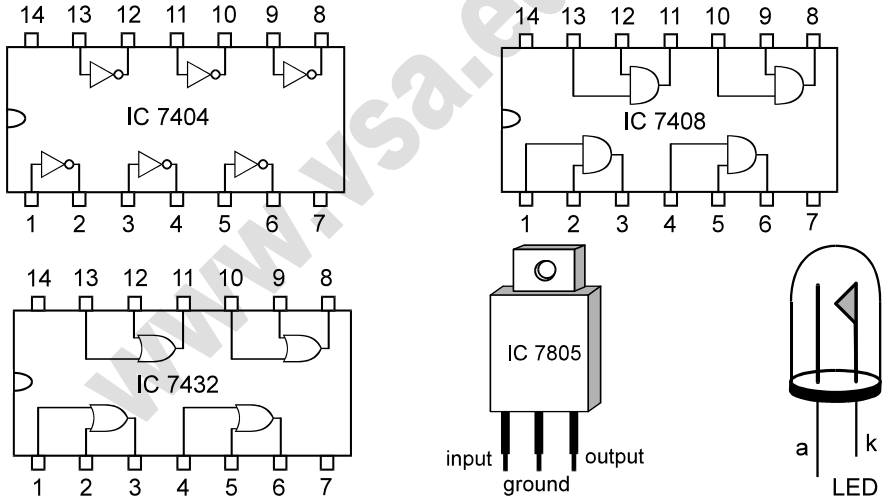
e) Compare the theoretical and practical values by tabulating them. **(5)**

f) Oral **(5)**

Circuit diagrams –



Pin configurations of the ICs –



Specifications of components –

Type of component	Specifications
IC 7404	Hex inverter, NOT gate
IC 7408	Quad 2–input AND gate
IC 7432	Quad 2–input OR gate
IC 7805	+5V, 3–terminal regulator IC
Resistors	330Ω, ¼W, carbon composition, ±5% tolerance
LED	color _____ , VF = _____
Diodes	1N4001 rectifier diode
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer

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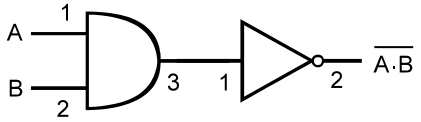
De Morgan's theorems (Slip-2)

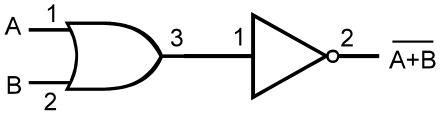
HSC Board Questions Slip (Study of De Morgan's Theorems)

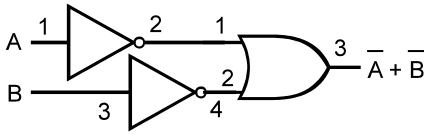
You are given ICs _____, _____, _____.

a) Identify them and draw their pin configurations. Write their typical specifications. (5)
b) State De Morgan's theorems and draw the circuit diagram for varifying them. (5)
c) Connect the circuits and show them to the examiner. (5)
d) Test the outputs for various combinations of inputs. Tabulate the results. (5)
e) Compare experimentally observed results and expected results. (5)
f) Oral (5)

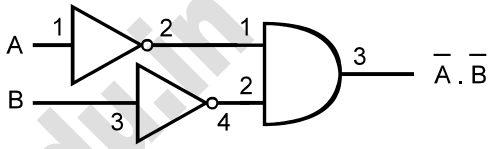
Circuit diagrams –





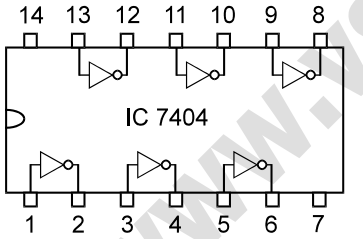


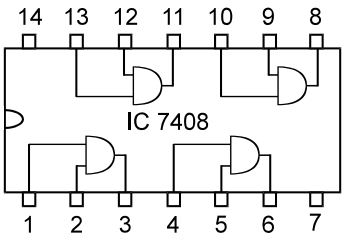
NAND gate is equivalent to bubbled OR gate

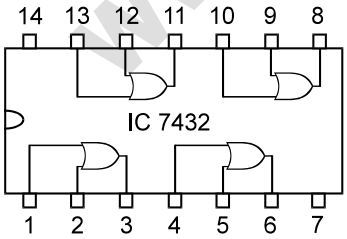


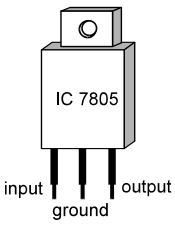
NOR gate is equivalent to bubbled AND gate

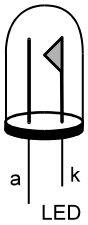
Pin configurations of the ICs –











Specifications of components –

Type of component	Specifications
IC 7404	Hex inverter, NOT gate
IC 7408	Quad 2–input AND gate
IC 7432	Quad 2–input OR gate
IC 7805	+5V, 3–terminal regulator IC
Resistors	330Ω, ¼W, carbon composition, ±5% tolerance
LED	color _____ , VF = _____
Diodes	1N4001 rectifier diode
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer

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Universal Building Blocks (Slip-3)

HSC Board Questions Slip (Study of Universal Building Blocks)

You are given ICs _____, _____.

a) Identify them and draw their pin configurations. Write their typical specifications. **(5)**

b) Draw the circuit diagram for constructing the basic gates using NAND/NOR gates. **(5)**

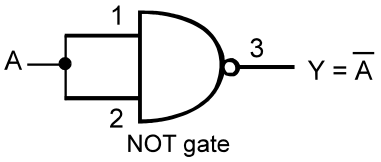
c) Connect the circuit and get it checked by the examiner. **(5)**

d) Switch on circuit and check its output for different combinations of inpts. Draw TTs. **(5)**

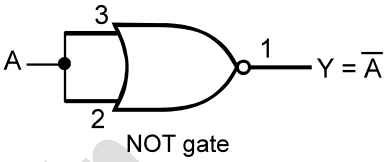
e) Compare the theoretical and practical values in tabular form. **(5)**

f) Oral **(5)**

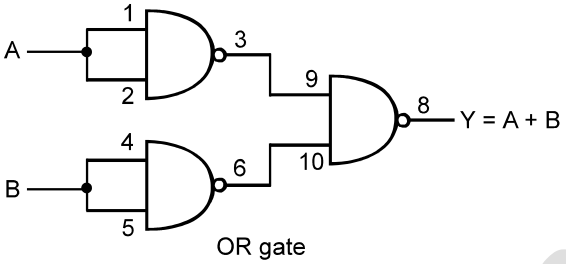
Circuit diagrams –



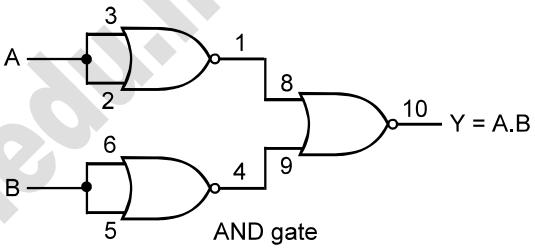
NOT gate



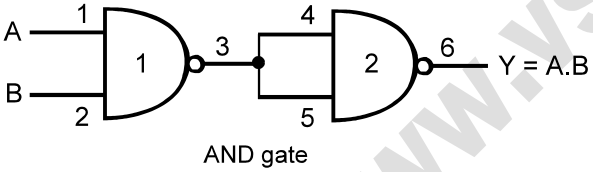
NOT gate



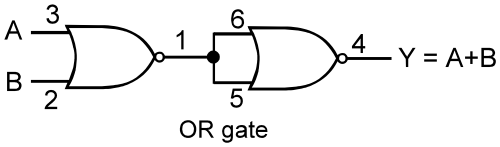
OR gate



AND gate

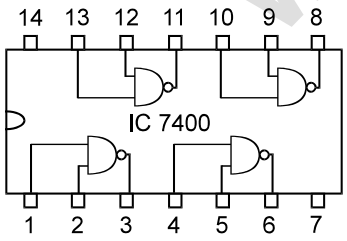


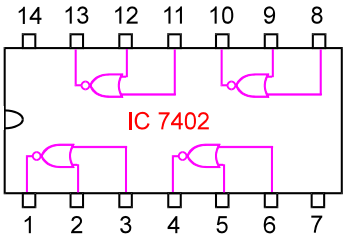
AND gate

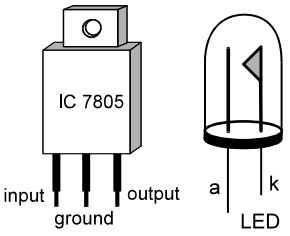


OR gate

Pin configurations of the ICs –







Specifications of components –

Type of component	Specifications
IC 7400	Quad 2–input NAND gate
IC 7402	Quad 2–input NOR gate
IC 7805	+5V, 3–terminal regulator IC
Resistors	330Ω, ¼W, carbon composition, ±5% tolerance
LED	color _____ , VF = _____
Diodes	1N4001 rectifier diode
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer

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Boolean Equations (Slip-4)

HSC Board Questions Slip (Study of Boolean Equations)

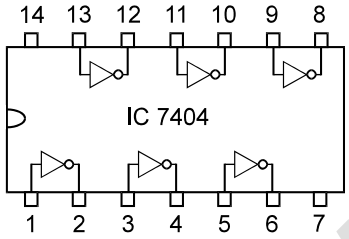
You are given with the Boolean equation → _____

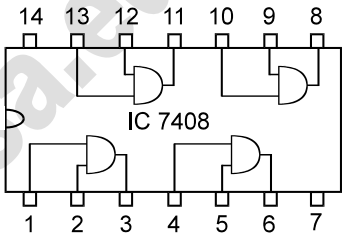
a) Draw the logic diagram for given logic equation and list the gates required. (5)
b) Reduce the equation using Boolean laws and again draw the logic diagram. (5)
c) List the ICs required, give their pin configurations and specifications. (5)
d) Connect the circuit and test it. (5)
e) Varify output of circuit by comparing experimental & expected results. Tabulate them. (5)
f) Oral (5)

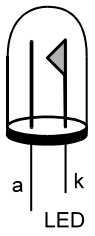
Circuit diagram –

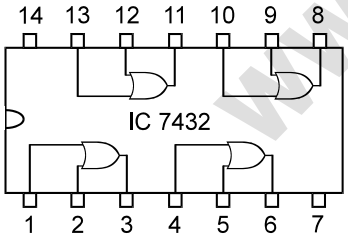
The student must draw the circuit diagram of given equation.
For this experiment, circuit diagram will NOT be supplied.

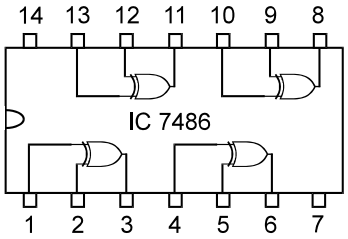
Pin configurations of basic ICs –

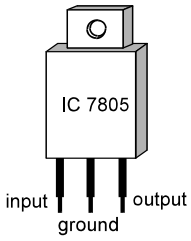












Specifications of components –

Type of component	Specifications
IC 7404	Hex inverter, NOT gate
IC 7408	Quad 2–input AND gate
IC 7432	Quad 2–input OR gate
IC 7805	+5V, 3–terminal regulator IC
Resistors	330Ω, ¼W, carbon composition, ±5% tolerance
LED	color _____ , VF = _____
Diodes	1N4001 rectifier diode
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer

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Ex-OR gate using Basic gates (Slip-5)

HSC Board Questions Slip (Study of Ex–OR gate)

You are given ICs: IC 7408, IC 7432 and IC 7404.

a) Identify them. **(3)** b) Define Ex–OR logic. **(1)** c) Write TT of Ex–OR gate. **(1)**

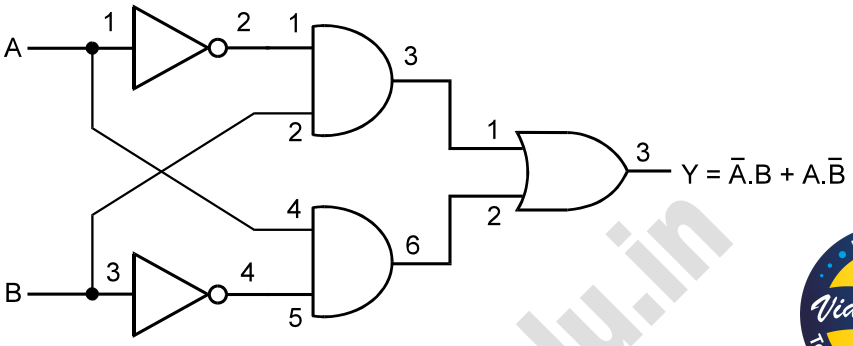
d) Draw the logic diagram of Ex–OR gate using basic gates and connect the circuit. **(10)**

e) Verify working of circuit constructed by you as per TT. **(3)**

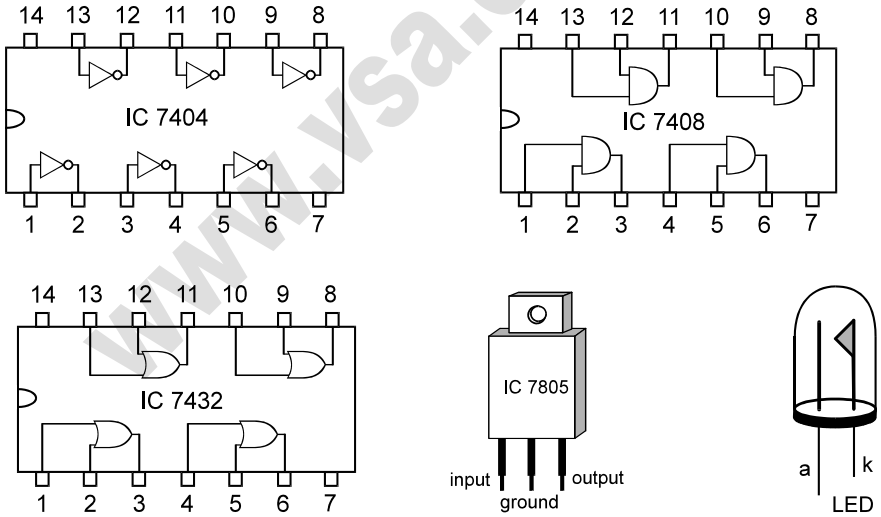
f) Convert it to Ex–NOR and again test the circuit. **(2)** g) Test IC 7486. **(5)**

h) Oral **(5)**

Circuit diagram –



Pin configurations of ICs –



Specifications of components –

Type of component	Specifications
IC 7404	Hex inverter, NOT gate
IC 7408	Quad 2–input AND gate
IC 7432	Quad 2–input OR gate
IC 7486	Quad 2–input Ex-OR gate
IC 7805	+5V, 3–terminal regulator IC
Resistors	330Ω, ¼W, carbon composition, ±5% tolerance
LED	color _____ , VF = _____
Diodes	1N4001 rectifier diode
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer

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Ex-OR gate using NAND gates (Slip-6)

HSC Board Questions Slip (Study of Ex–OR gate)

You are given ICs: IC 7400 and IC 7486.

b) Identify them and draw their pin diagrams showing the layout of gates. **(4)**

c) Define Ex–OR logic. **(1)**

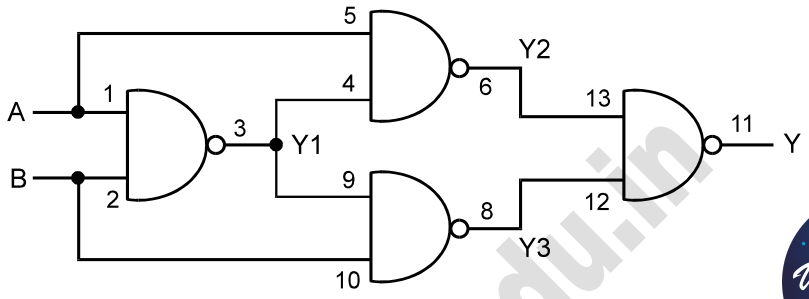
d) Draw logic diagram of Ex–OR gate using NAND gates. How will you convert it to Ex–NOR? Draw the circuit again. **(5)**

e) Connect the circuit of Ex–OR using NAND gates and verify the output as per TT. **(10)**

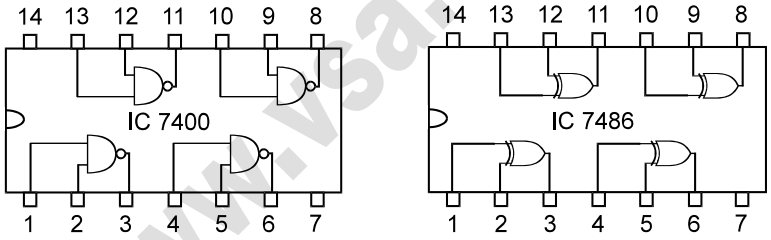
f) Test IC 7486 separately. **(5)**

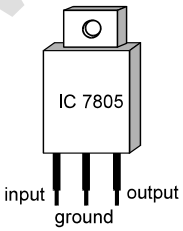
g) Oral **(5)**

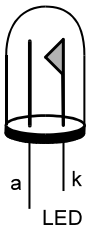
Circuit diagram –



Pin configurations of ICs –







Specifications of components –

Type of component	Specifications
IC 7400	Quad 2–input NAND gate
IC 7486	Quad 2–input Ex–OR gate
IC 7805	+5V, 3–terminal regulator IC
Resistors	330Ω, ¼W, carbon composition, ±5% tolerance
LED	color _____ , VF = _____
Diodes	1N4001 rectifier diode
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer

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Controlled Inverter (Slip-7)

HSC Board Questions Slip (Study of controlled inverter using Ex–OR)

You are given IC 7486.

h) Identify the IC and draw its pin configuration. **(5)**

i) Draw the circuit diagram of a 4–bit controlled inverter. **(5)**

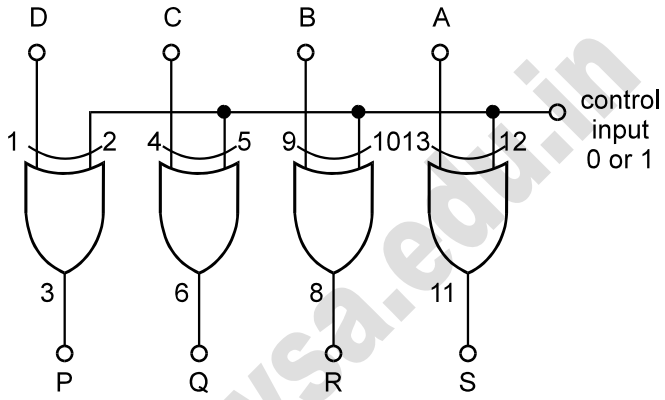
j) Write the working of 4–bit controlled inverter and mention its one application. **(5)**

k) Connect the circuit of controlled inverter. **(5)**

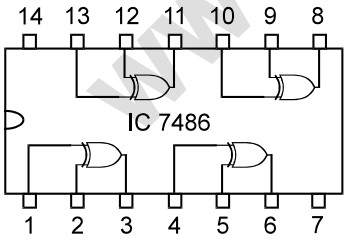
l) Demonstrate the working of your circuit for any two 4–bit binary numbers and note down the input and output numbers. Write their result and show it to examiner. **(5)**

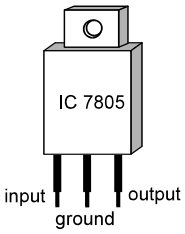
m) Oral **(5)**

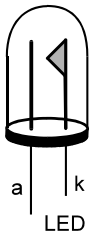
Circuit diagram –



Pin configurations of ICs –







Specifications of components –

Type of component	Specifications
IC 7486	Quad 2–input Ex–OR gate
IC 7805	+5V, 3–terminal regulator IC
Resistors	330Ω, ¼W, carbon composition, ±5% tolerance
LED	color _____ , VF = _____
Diodes	1N4001 rectifier diode
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer

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Noise Margin (Slip-8)

HSC Board Questions Slip (Study of controlled inverter using Ex–OR)

You are given IC 7404.

n) Write its specifications and pin diagram. **(5)**

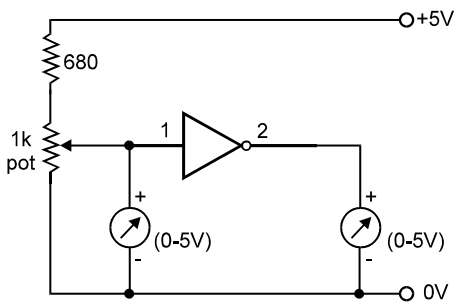
o) Draw the circuit arrangement for determination of input and output voltage characteristics. **(5)**

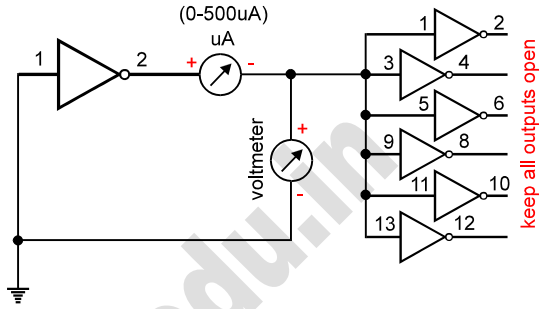
p) Measure the output voltages for different input voltages starting from 0Volts to 1.5Volts. Tabulate the readings (at least 15 readings). **(5)**

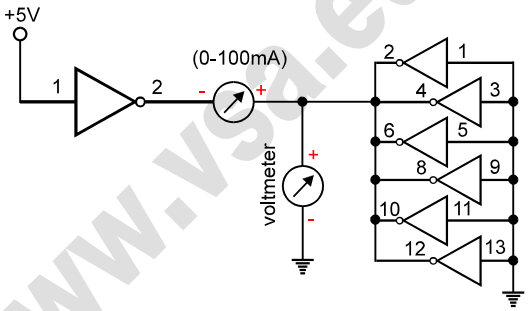
q) Measure source current, sink current and output voltage for various loads (by connecting different number of NOT gates to output i.e. one to five NOT gates, tabulate the readings. **(5)**

r) Oral **(5)**

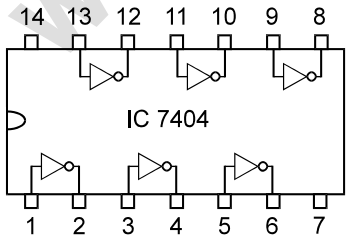
Circuit diagrams –

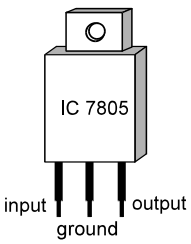






Pin configurations of ICs –





Specifications of components –

Type of component	Specifications
IC 7404 (2 Nos.)	Hex inverter, NOT gate
IC 7805	+5V, 3–terminal regulator IC
Resistors	330Ω, ¼W, carbon composition, ±5% tolerance
LED	color _____ , VF = _____
Diodes	1N4001 rectifier diode
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer

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RS FF using NAND/NOR gates (Slip-9)

HSC Board Questions Slip (Study of RS FF using NAND & NOR gates)

You are given IC 7400 and 7402.

s) Identify the IC and draw its pin specifications. **(2)**

t) Draw circuit diagram of RS FF using NAND gates and write its TT. **(5)**

u) Construct the circuit and verify the truth table. **(5)**

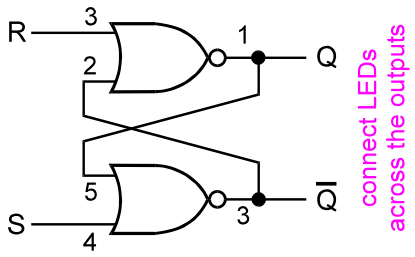
v) Draw circuit diagram of RS FF using NOR gates and write its TT. **(5)**

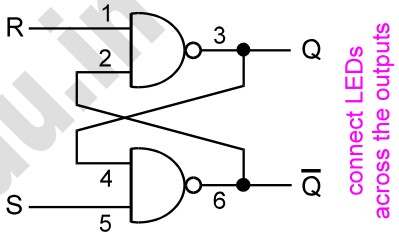
w) Construct the circuit and verify the truth table. **(5)**

x) Compare the TTs of RS FF using NAND and NOR gates and write the difference. **(3)**

y) Oral **(5)**

Circuit diagrams –





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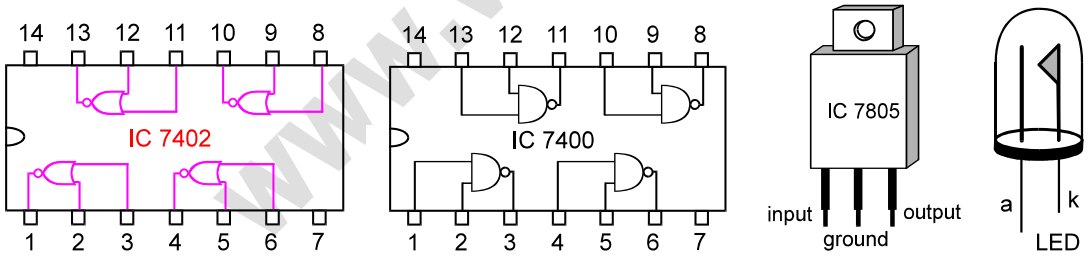
Pin configurations of the ICs –



Specifications of components –

Type of component	Specifications
IC 7400	Quad 2–input NAND gate
IC 7402	Quad 2–input NOR gate
IC 7805	+5V, 3–terminal regulator IC
Resistors	330Ω, ¼W, carbon composition, ±5% tolerance
LED	color _____ , VF = _____
Diodes	1N4001 rectifier diode
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer

Decoder (Slip-13)

HSC Board Questions Slip (Study of Decoder)

You are given IC 7447/IC 7448 with 7–segment display.

z) Identify the ICs and draw their specifications. **(5)**

aa) Draw the circuit diagram for testing the above ICs. **(5)**

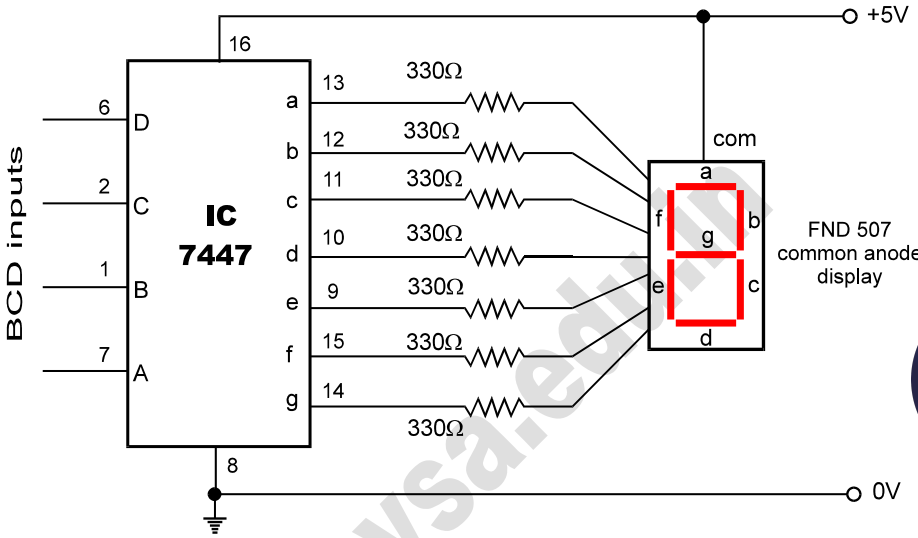
bb) Connect it to obtain different digits for different BCD inputs. **(5)**

cc) Test the circuit for different input conditions. **(5)**

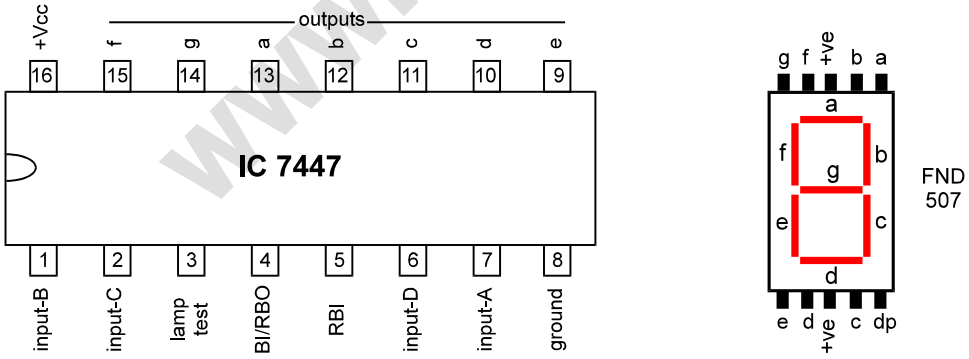
dd) Tabulate the observations. **(5)**

ee) Oral **(5)**

Circuit diagrams –



Pin configurations –



Specifications of components –

Type of component	Specifications
IC 7447	14–pin, BCD to 7–segment decoder/driver TTL IC
FND 507	color _____ , VF of LED segment = _____
IC 7805	+5V, 3–terminal regulator IC
Resistors	330Ω, ¼W, carbon composition, ±5% tolerance
Diodes	1N4001 rectifier diode
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer

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Half Adder (Slip-15)

HSC Board Questions Slip (Study of half adder)

ff) Draw the logic diagram of half adder using logic gates. **(5)**

gg) List the number of ICs required, write their specifications and pin configurations. **(5)**

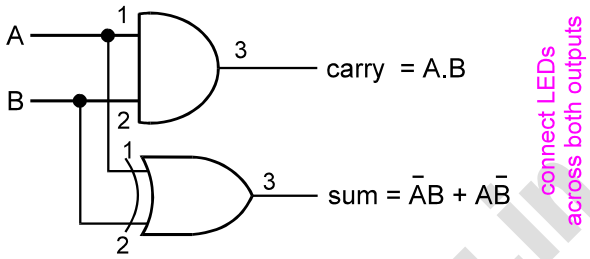
hh) Construct the circuit on the given board. **(5)**

ii) Test the circuit for all possible input combinations. **(5)**

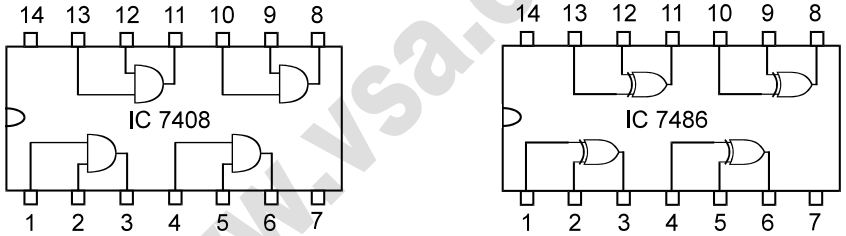
jj) Tabulate the results. **(5)**

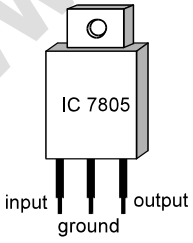
kk) Oral **(5)**

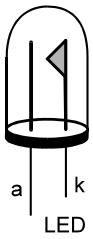
Circuit diagram –



Pin configurations of ICs –







Specifications of components –

Type of component	Specifications
IC 7408	Quad 2–input AND gate
IC 7486	Quad 2–input Ex-OR gate
IC 7805	+5V, 3–terminal regulator IC
Resistors	330Ω, ¼W, carbon composition, ±5% tolerance
LED	color _____ , VF = _____
Diodes	1N4001 rectifier diode
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer

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Full Adder (Slip-16)

HSC Board Questions Slip (Study of full adder)

ll) Draw the logic diagram of full adder using logic gates. **(5)**

mm) List the number of ICs required, write their specifications and pin configurations. **(5)**

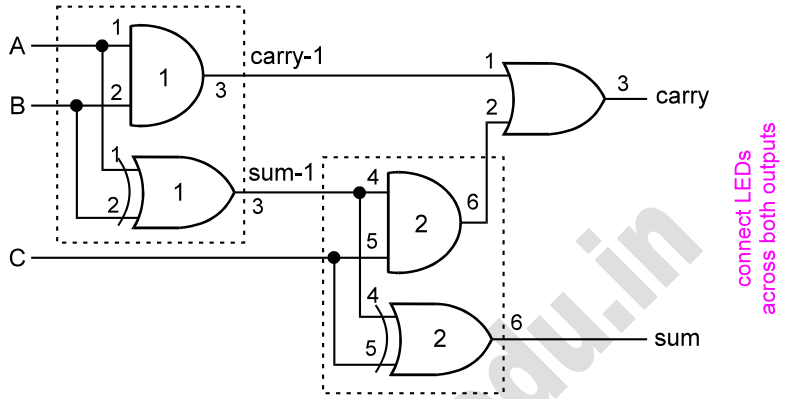
nn) Construct the circuit on the given board. **(5)**

oo) Test the circuit for all possible input combinations. **(5)**

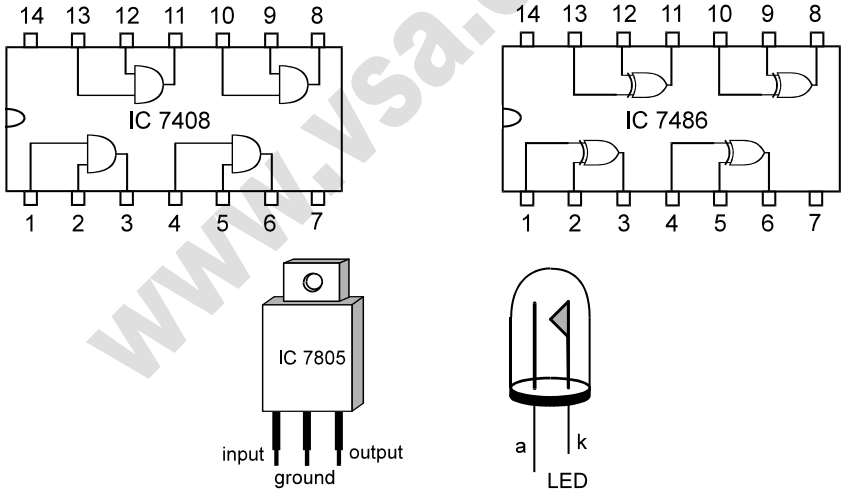
pp) Tabulate the results. **(5)**

qq) Oral **(5)**

Circuit diagram –



Pin configurations of ICs –



Specifications of components –

Type of component	Specifications
IC 7408	Quad 2–input AND gate
IC 7486	Quad 2–input Ex-OR gate
IC 7805	+5V, 3–terminal regulator IC
Resistors	330Ω, ¼W, carbon composition, ±5% tolerance
LED	color _____ , VF = _____
Diodes	1N4001 rectifier diode
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer

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4–bit Binary Adder (Slip-17)

HSC Board Questions Slip (study of 4–bit binary adder)

rr) You are given IC 7483. Identify the IC and write its specifications. Draw pin configuration. **(5)**

ss) Construct the circuit for addition of two 4–bit binary numbers. **(5)**

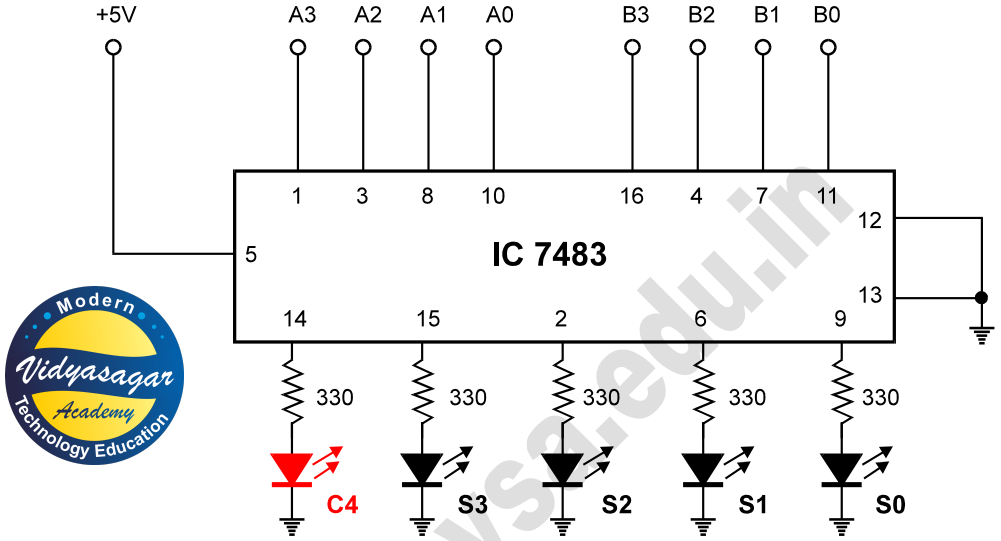
tt) Add following number after converting into their binary equivalents and verify the results. **(10)**

( )$_{10}$ + ( )$_{10}$, ( )$_{10}$ + ( )$_{10}$, ( )$_{10}$ + ( )$_{10}$, ( )$_{10}$ + ( )$_{10}$, ( )$_{10}$ + ( )$_{10}$,

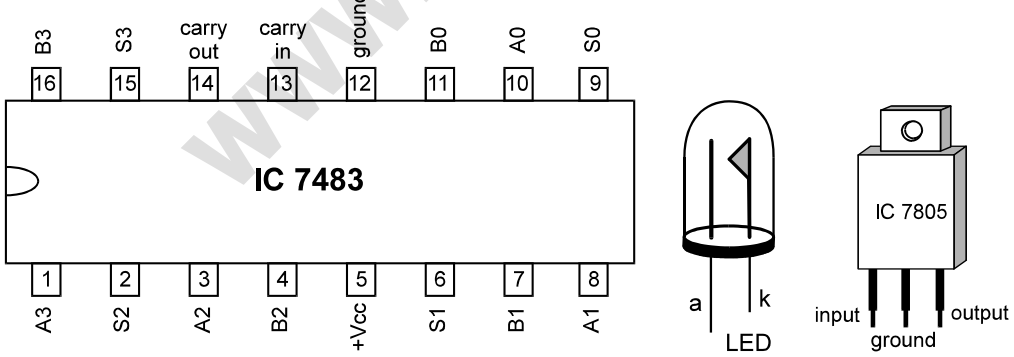
uu) How can this circuit be used for 4–bit binary subtraction? Draw the circuit diagram. **(5)**

vv) Oral **(5)**

Circuit diagram –



Pin configurations –



Specifications of components –

Type of component	Specifications
IC 7483	4–bit full adder TTL IC, supply voltage = 5V, 16 pins IC
IC 7805	+5V, 3–terminal regulator IC
Resistors	330Ω, ¼W, carbon composition, ±5% tolerance
LED	color _____ , VF = _____
Diodes	1N4001 rectifier diode
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer

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Schmitt Trigger Inverter (Slip-18)

HSC Board Questions Slip (Schmitt trigger inverter)

ww) You are given IC 7414. Identify IC and write its specifications. Draw pin configuration. **(5)**

xx) Draw the circuit diagram of square wave generator using above IC. **(5)**

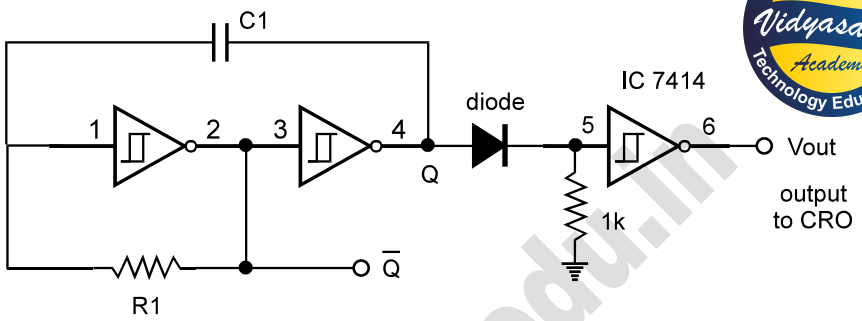
yy) Write the expression for the period of output waveform. Calculate the values of R & C for three different frequencies. Draw the ideal output voltage waveform of the circuit. **(5)**

zz) Connect the circuit for different values of R & C. Observe the waveforms on CRO. **(5)**

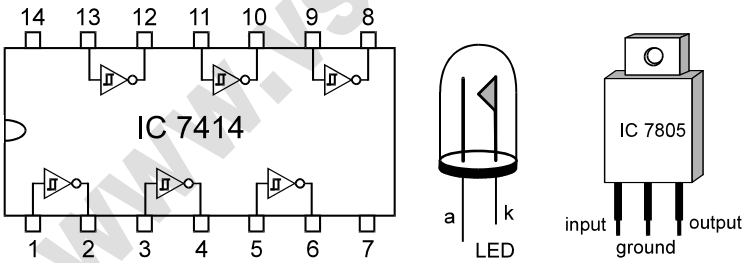
aaa) Measure the periods and frequencies and compare them with theoretical values. **(5)**

bbb) Oral. **(5)**

Circuit diagram –



Pin configurations of the ICs –



Specifications of components –

Type of component	Specifications
IC 7414	Schmitt trigger hex inverter, TTL IC
IC 7805	+5V, 3–terminal regulator IC
Resistors	330Ω, ¼W, carbon composition, ±5% tolerance
	1kΩ,¼W, carbon composition, ±5% tolerance
	220Ω, ¼W, carbon composition, ±5% tolerance
	180Ω,¼W, carbon composition, ±5% tolerance
Diodes	1N4001 rectifier diode
Capacitors	1000μF/25V electrolytic filter capacitor
	0.1μF/32V, ceramic capacitor
	0.2μF/32V, ceramic capacitor
	0.05μF/32V, ceramic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer

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D/A Conveter (Slip-19)

HSC Board Questions Slip (Digital to Analog Converter)

ccc) Draw the circuit diagram of 4–bit D/A converter using R–2R ladder (use opamp at output). **(5)**

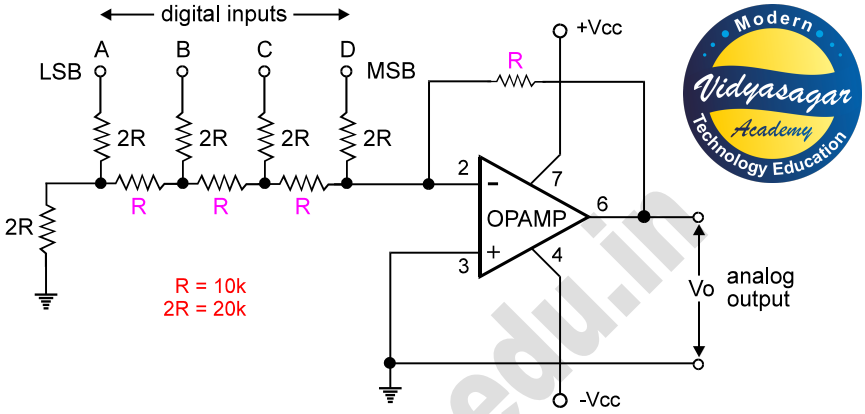
ddd) Assemble the circuit. **(5)**

eee) Observe the output for all binary inputs (from 0000 to 1111) **(5)**

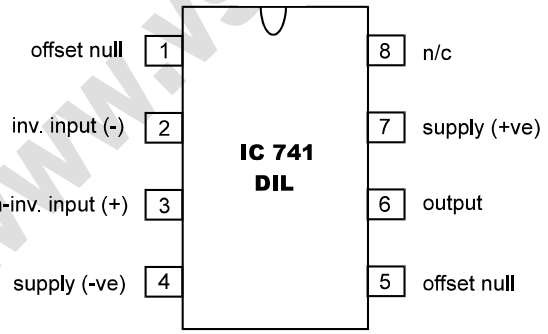
fff) Tabulate the readings. **(5)**

ggg) Plot the graph of analog output voltage versus digital inputs. **(5)**

Circuit diagram –



Pin configurations of the IC –



Specifications of components –

Type of component	Specifications
IC 741	Operational amplifier, 8 pins, ±18Vmax dual power supply
IC 7812	+12V, 3–terminal regulator IC
IC 7912	–12V, 3–terminal regulator IC
Resistors	10kΩ, ¼W, carbon composition, ±5% tolerance
	330Ω,¼W, carbon composition, ±5% tolerance
Potentiometer	1kΩ, linear potentiometer
Diodes	1N4001 rectifier diode
Capacitors	1000μF/25V electrolytic filter capacitor
Transformer	9V–0V–9V, 500mA secondary transformer

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D/A Conveter (Slip-20)

HSC Board Questions Slip (Digital to Analog Converter)

iii) Draw the circuit diagram of 4–bit D/A converter using R–2R ladder (use opamp at output). **(5)**

jjj) Assemble the circuit. **(5)**

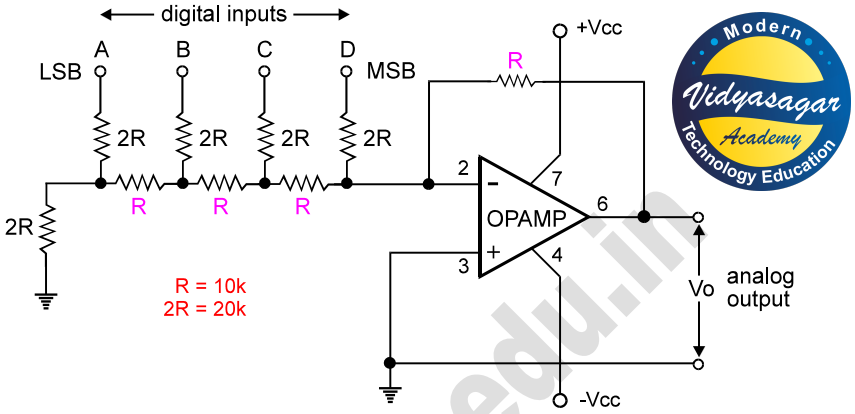
kkk) Observe the output for the binary inputs → ( ), ( ), ( ), ( ) **(5)**

lll) Calculate the output for the above binary inputs. **(5)**

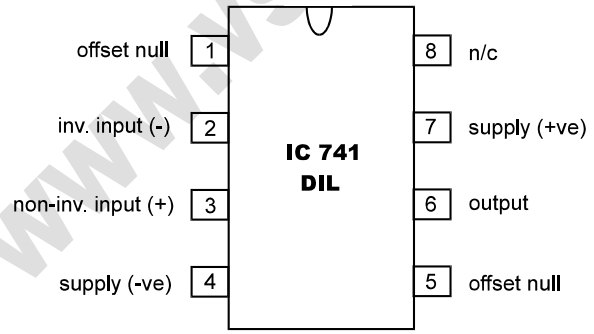
mmm) Compare the calculated and observed values. **(5)**

nnn) Oral. **(5)**

Circuit diagram –



Pin configurations of the IC –



Specifications of components –

Type of component	Specifications
IC 741	Operational amplifier, 8 pins, ±18Vmax dual power supply
IC 7812	+12V, 3–terminal regulator IC
IC 7912	–12V, 3–terminal regulator IC
Resistors	10kΩ, ¼W, carbon composition, ±5% tolerance
	330Ω,¼W, carbon composition, ±5% tolerance
Potentiometer	1kΩ, linear potentiometer
Diodes	1N4001 rectifier diode
Capacitors	1000μF/25V electrolytic filter capacitor
Transformer	9V–0V–9V, 500mA secondary transformer

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Diode Matrix ROM (Slip-21)

HSC Board Questions Slip (Diode Matrix ROM)

ooo) Draw the circuit for 4 x 4 diode matrix ROM, for the following 4–bit words –

Location content of words –

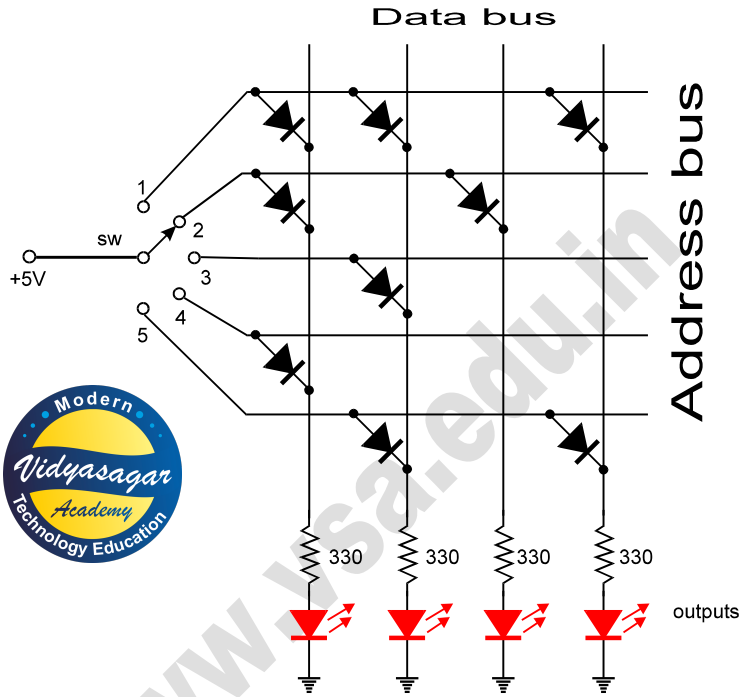
0 → ( )$_2$, 1 → ( )$_2$, 2 → ( )$_2$, 3 → ( )$_2$, (7)

ppp) Assemble the circuit. (8)

qqq) Test and verify the output for various locations. (10)

rrr) Oral. (5)

Circuit diagram –



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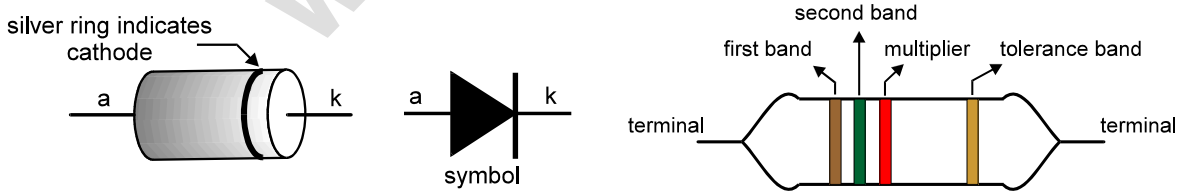
Pin configurations –



Specifications of components –

Type of component	Specifications
Resistors	10kΩ, ¼W, carbon composition, ±5% tolerance
	330Ω,¼W, carbon composition, ±5% tolerance
Potentiometer	1kΩ, linear potentiometer
Diodes	1N4001 rectifier diode
LEDs	color _____ , VF = _____
Capacitors	1000μF/25V electrolytic filter capacitor
Transformer	9V–0V–9V, 500mA secondary transformer
Rotary switch	1–pole, 5–way rotary switch