

Mechatronics

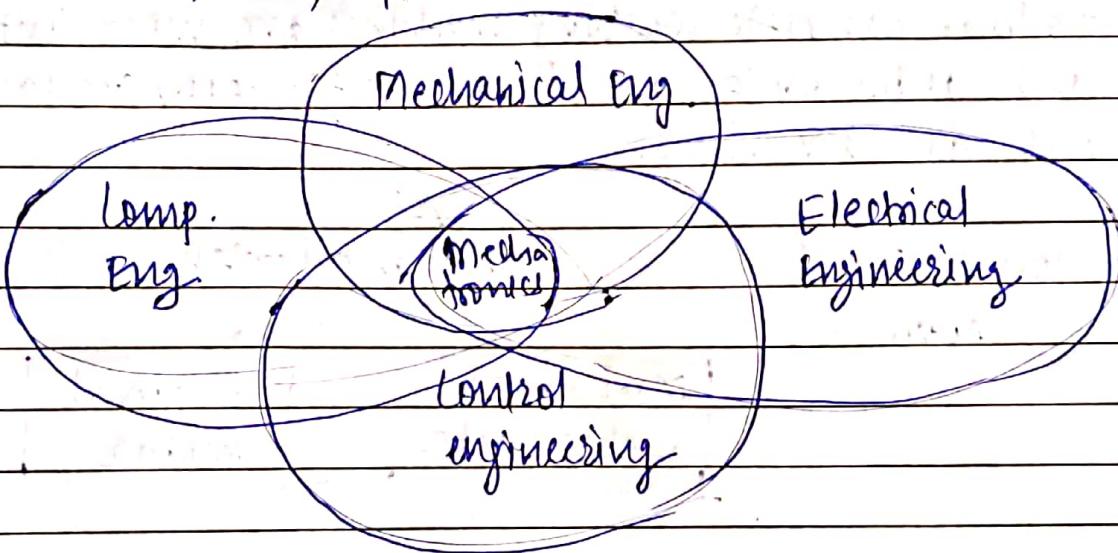
Q. What is Mechatronics & Explain Multidisciplinary scenario

Ans -

Mechatronics -

Mechatronics is a multidisciplinary engineering system design is a combination of mechanical engineering, Electronic engineering, computer engineering, control engineering and system design engineering

Multidisciplinary approach -



Mechatronics can also be termed as replacement of mechanics with electronics or enhance mechanics with electronics. It is the combination of mechanical and electronic engineering

mecha - mechanical engineering

tronics - electronic engineering

For example, in modern automobile mechanical fuel injection system are now replaced with electronic fuel injection system. The replacement made the automobile more efficient and less pollutant.

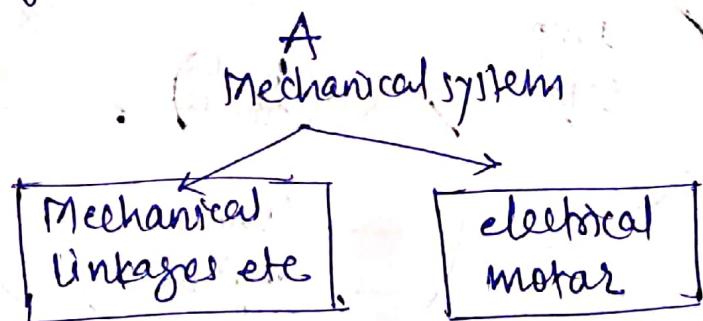
With the help of microelectronics and sensor technologies mechatronic system are providing high level of precision & reliability.

Due to reprogramable microcontrol it is now possible to move production machine tool from $x \rightarrow y$ by 0.0001mm

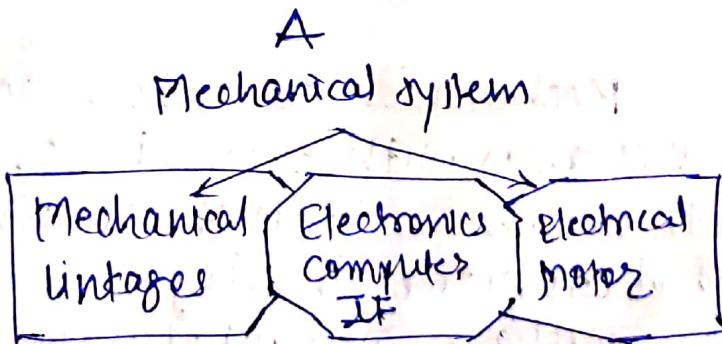
It is now very easy to add new functionalities to the system

Today's domestic washing machines are more intelligent and automobiles are equipped with safety installation such as air bags.

Conventional Approach



Mechatronic Approach



②

Ans -

Explain filtering process with types of filters.

The term filtering is used to describe the process of removing a certain band of frequencies from a signal and permitting others to be transmitted. The range of frequencies passed by a filter is called as a pass band, the range not passed are called stop band and the boundary between stopping and passing is the cutoff frequency. The filters are classified according to the frequency ranges they transmit or reject.

① A low pass filter -

Has a pass band which are all the frequencies from 0 upto some frequency to be transmitted.

This shown in fig(1)

② A high pass filter -

has a pass band which allows all frequencies from some value upto infinity to be transmitted.

This is shown in fig(2)

③ A band pass filter -

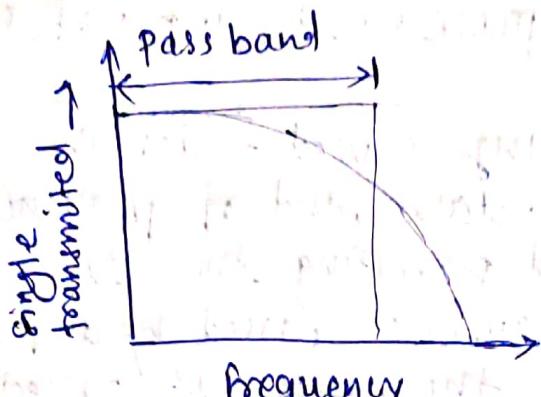
Allows all frequencies within a specific band to be transmitted.

④ A band stop filter -

Stop all frequencies within particular bands from being transmitted

filters could be Active
passive

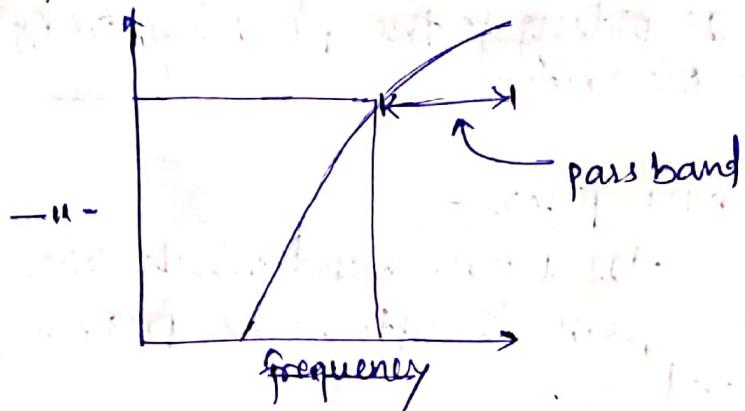
① Low pass



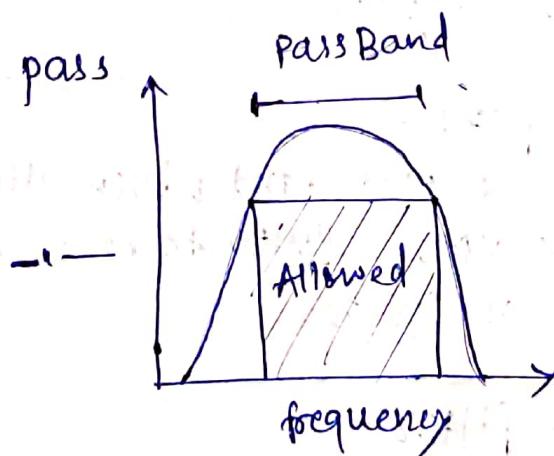
passive made up of
resistors, capacitors, inductor

Active involves
opamp

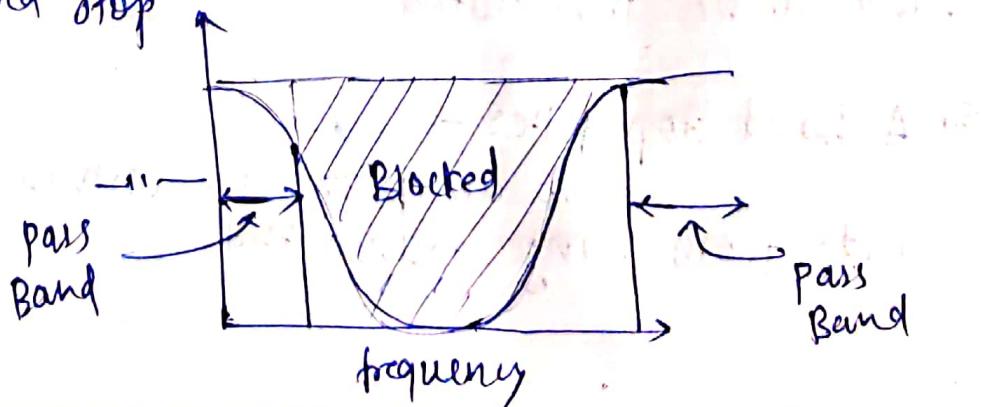
② High pass



③ Band pass



④ Band stop



Q. Draw A logic diagram to meet following conditions.

Coffee / Tea Vending machine -

- ① System dispense tea or coffee when a appropriate button is pressed
- ② AND logic will check for money input criteria and required drink.
- ③ If by mistake both buttons are pressed machine should dispense tea

Ans -

Inputs -

Input A (coffee maker)

0 = No State ; 1 = coffee filling

Input B (coin)

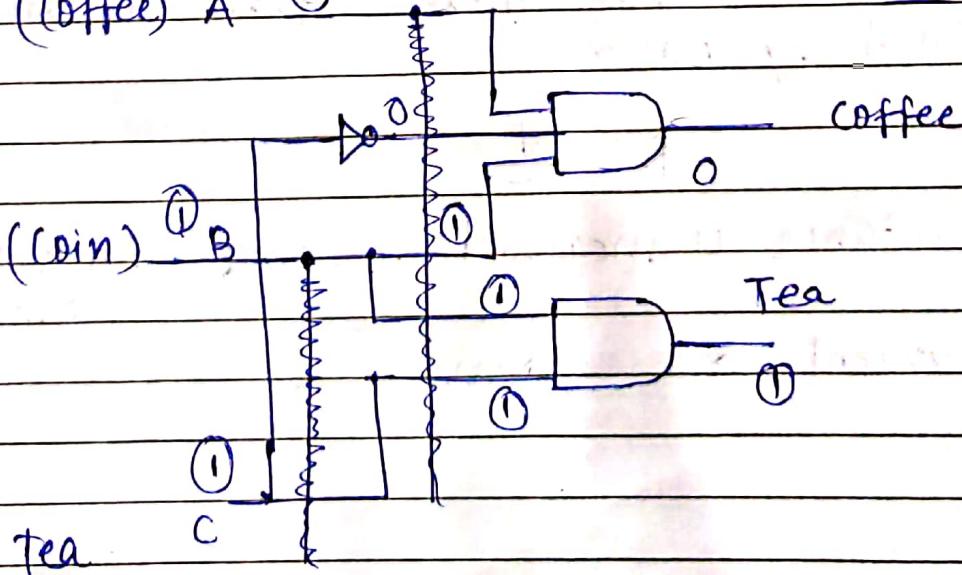
0 = No coin enter ; 1 = coin enters

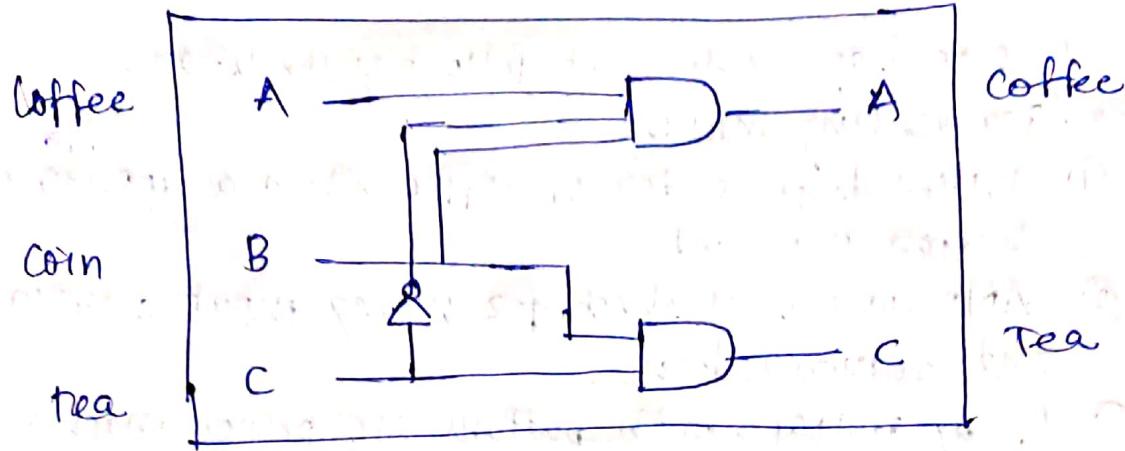
Input C (Tea maker)

0 = No State ; 1 = tea filling

(coffee) A ①

Back to the page





④ Write a note on basic electrical components used in mechatronics system.

Ans - Registers, Capacitors, Inductors. Basic electrical component each play important role in electric circuit. Also have own standard symbols

Registers -

A register represents a given amount of resistance in a circuit.

Resistance is a measure of how flow of electric current is opposed. It is defined by ohms law which says the resistance equals to the Voltage divided by current.

$$R = \frac{V}{I}$$

Resistance is measured in ohms, represented by a symbol →

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Capacitors -

A capacitor represents the amount of capacitance in a circuit. The capacitance is the ability of a component to store an electric charge. It is the capacity to store a charge.

The equation for capacitance.

$$C = q/v$$

q = charge in coulombs & V = Voltage

Measured in -

Farad

Symbol

C

Inductors -

An inductor represents amount of inductance in a circuit. The inductance is the ability of a component to store a & generate an electromotive force due to change in flow of current. A simple inductor is made up of looping a wire into (coil)

Inductance is measured in Henrys

letter L used in equation

Symbol →



⑤ Mention diff between hydraulic & pneumatic system

HS

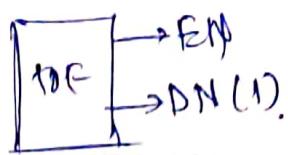
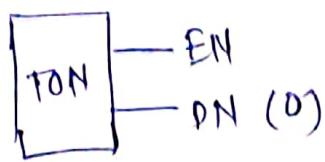
- ① A HS is closed-loop system
- ② It is robust in construction and High cost maintenance
- ③ The working fluid is hydraulic oil
- ④ As oil is incompressible, so it can be pressurized to very high pressure
- ⑤ The system is bulky due to high pressure
- ⑥ Accuracy is high
- ⑦ Hydraulic oil is flammable
- ⑧ To protect against rust need special attention

PS

- A PS is open-loop system
- ② simple in construction & maintenance cost is less
- ③ The working fluid is air
- ④ Air is compressible so can be pressurized to low pressure
- ⑤ The system is less bulky compared to HS
- ⑥ Accuracy is not high
- ⑦ Air is inflammable
- ⑧ no special attention required

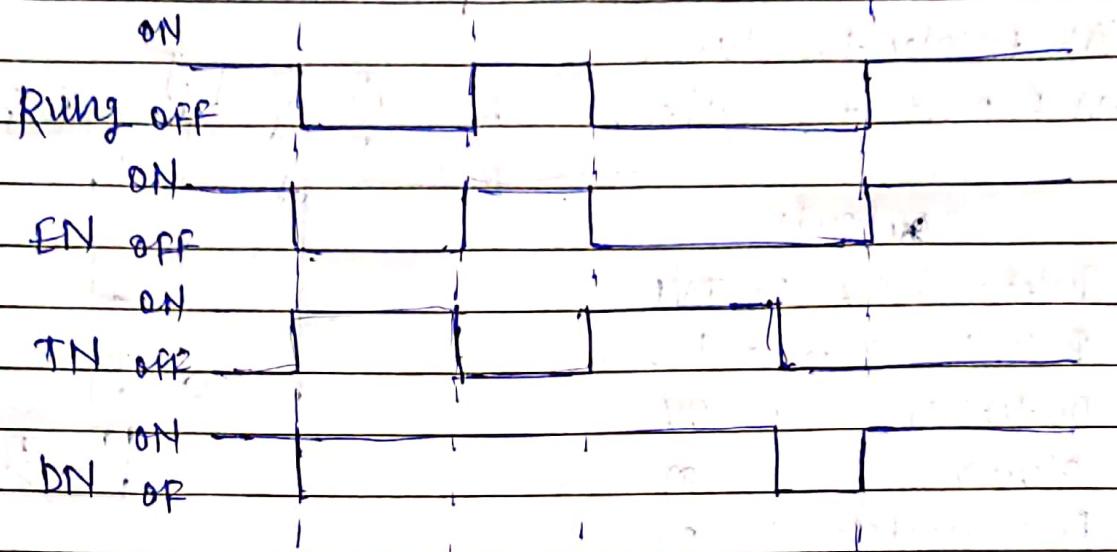
⑥ Draw the timing diagram for the following timer instruction bit

- i) I:0/0 ii) EN iii) DN iv) TT



Page No.		
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Timing diagram for TON EN DN TN



TON
if input is given, enable bit will be ON and hold rung ON
TN will start counting and remains ON till counter is running.

As preset = All men DN will be ON

TOF
If input is given, enable bit will be ON and as timer will reach the limit DN bit will be OFF(0)

0 = OFF

1 = ON

TON

EN = 1 then TN = 1

EN = 0 then TN = 0, DN = 0

EN = 1, TN = 0 then DN = 1

TOF

EN = 1, TN = 0

EN = 0, TN = 1, DN = 1

EN = 0, TN = 0, DN = 0

Construct ladder diagram

- i) Fill the tank with liquid A & B
- ii) Heat and stir the liquid for three minutes
- iii) Empty the tank
- iv) Repeat the cycle.

outputs

Inlet Valve A :- IV1

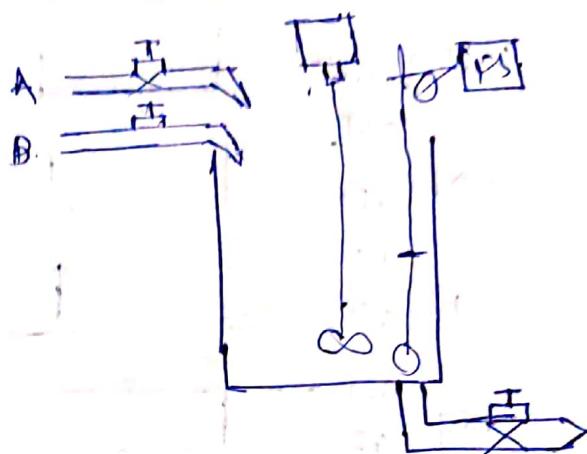
Inlet Valve B :- IV2

Outlet valve : OV

Motor : M

Fire switch : FS

Cycle start : CON

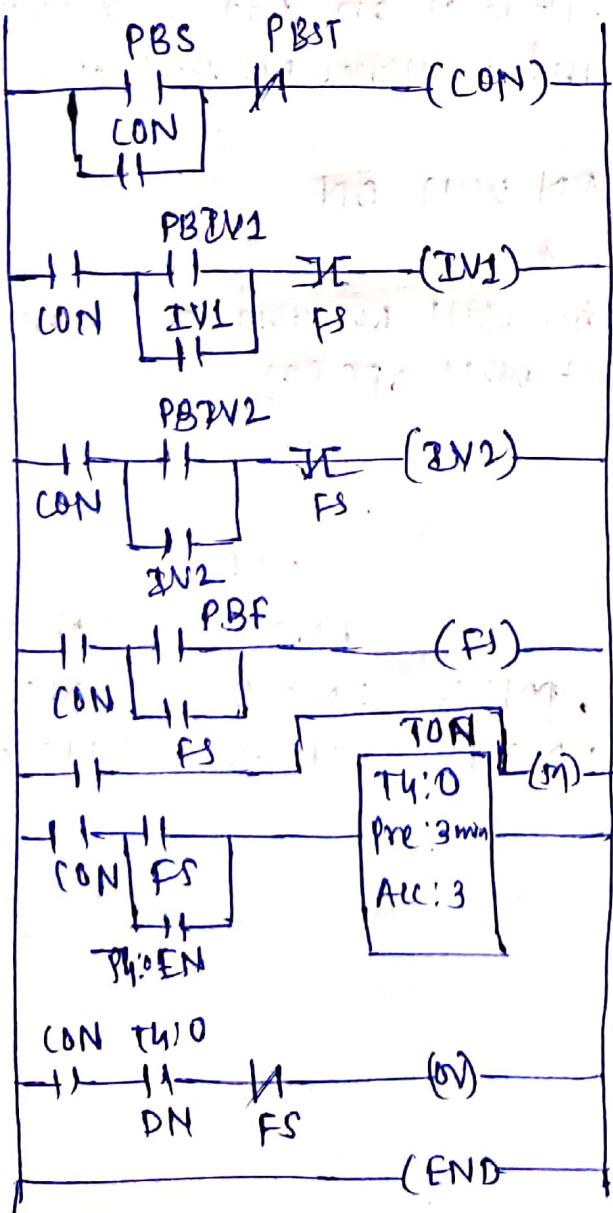


Cycle stop = PBST

Push button Inlet valve 1 = PBIV1

Push button Inlet valve 2 = PBIV2

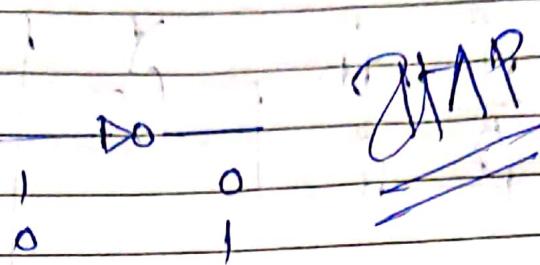
Push Button fire = PBF



Description

10) ladder diagram for all the gates.

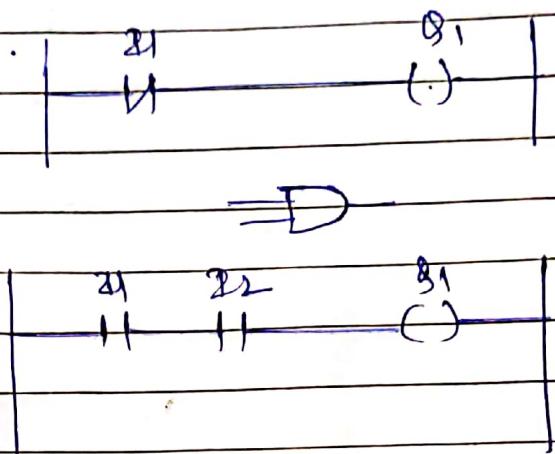
① NOT gate.



$$PB \text{ Press} = 1$$

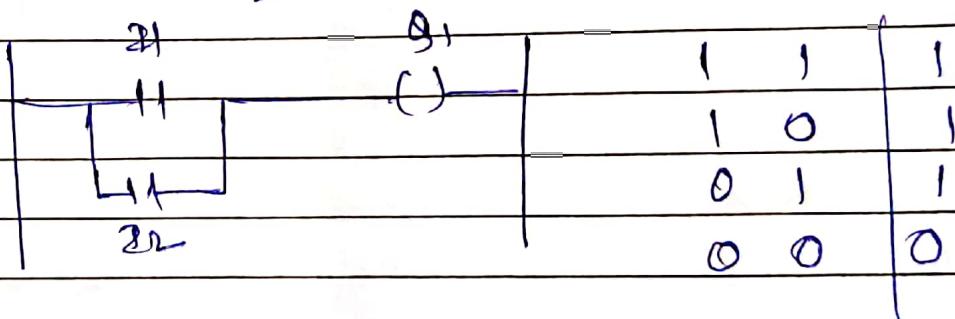
$$\begin{array}{l} PB \text{ NOT} \\ \text{pressed} \end{array} = 0$$

② AND gate



1	1	1
1	0	0
0	1	0
0	0	0

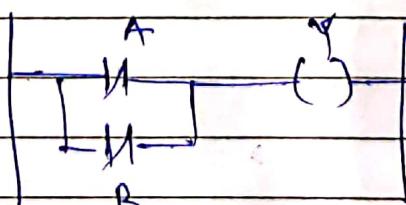
③ OR Gate



1	1	1
1	0	1
0	1	1
0	0	0

④ NAND gate

$$\overline{AB} = \overline{A} + \overline{B}$$



A	B	Y
1	1	0
1	0	1
0	1	1
0	0	1

⑤ NOR gate

$$\overline{A+B} = \overline{A} \cdot \overline{B}$$

$$\overline{D_o} = \overline{A} + \overline{B}$$

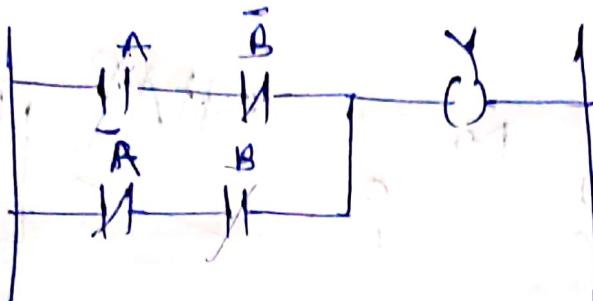
A	B	Y
1	1	0
1	0	0
0	1	0
0	0	1

$$A \oplus B = \overline{A}B + A\overline{B}$$

⑤ XOR

$$A \oplus B = \overline{A}\overline{B} + \overline{B}\overline{A}$$

$$= A\overline{B} + B\overline{A}$$

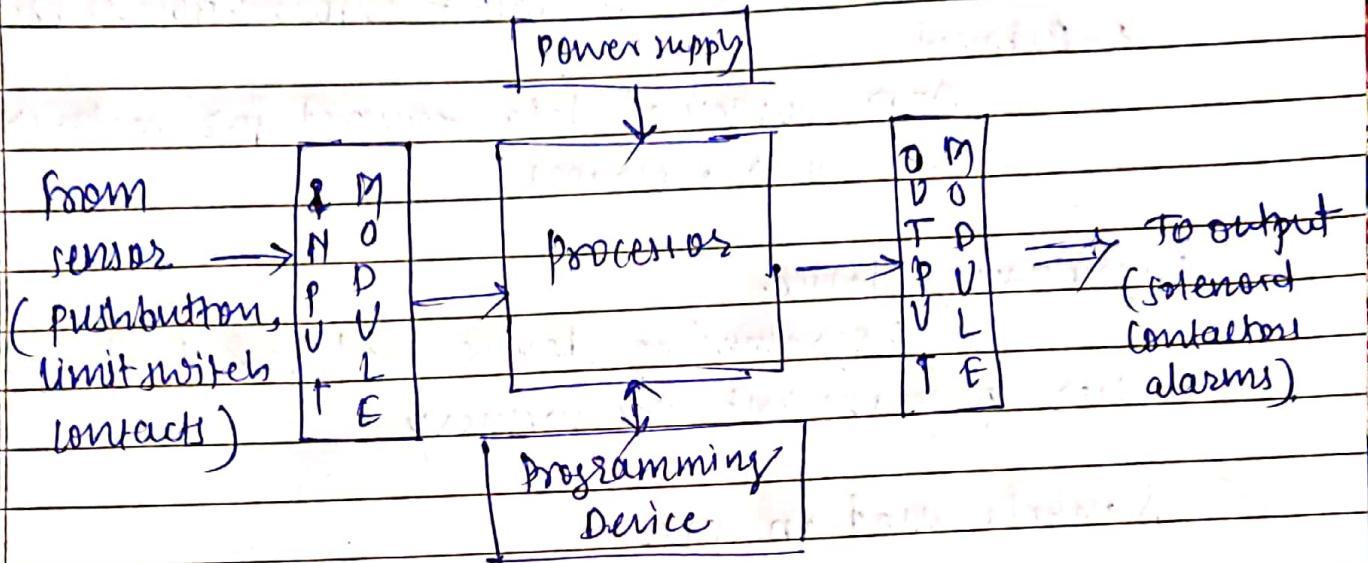


A	B	Y
0	0	0
1	0	1
0	1	1
1	1	0

If A pushed

then NC become NO
& NO become NC

22) Block diagram



processor - section -

The processor section is the brain of the PLC which consist of RAM, ROM, logic solver, and user memory. CPU is the heart of PLC. It controls monitors and supervise all operations. CPU makes decision and execute control instruction based on program instruction in memory.

Input and Output module -

The input module is mediator between input devices and CPU which is used to convert analog input signal to digital signal.

The output module is mediator between output devices and CPU which is used to convert digital signal to analog signal.

power supply -

power supply is provided to processor unit input and output module unit. Power supply may be integral or separately mounted.

Memory section-

- Area in which data & information is stored & retrieved
- Store numerical data required for math calculation
- Store user programs.

Programming device

Programming device used for loading the user program into the memory.

② Symbols used in PLC

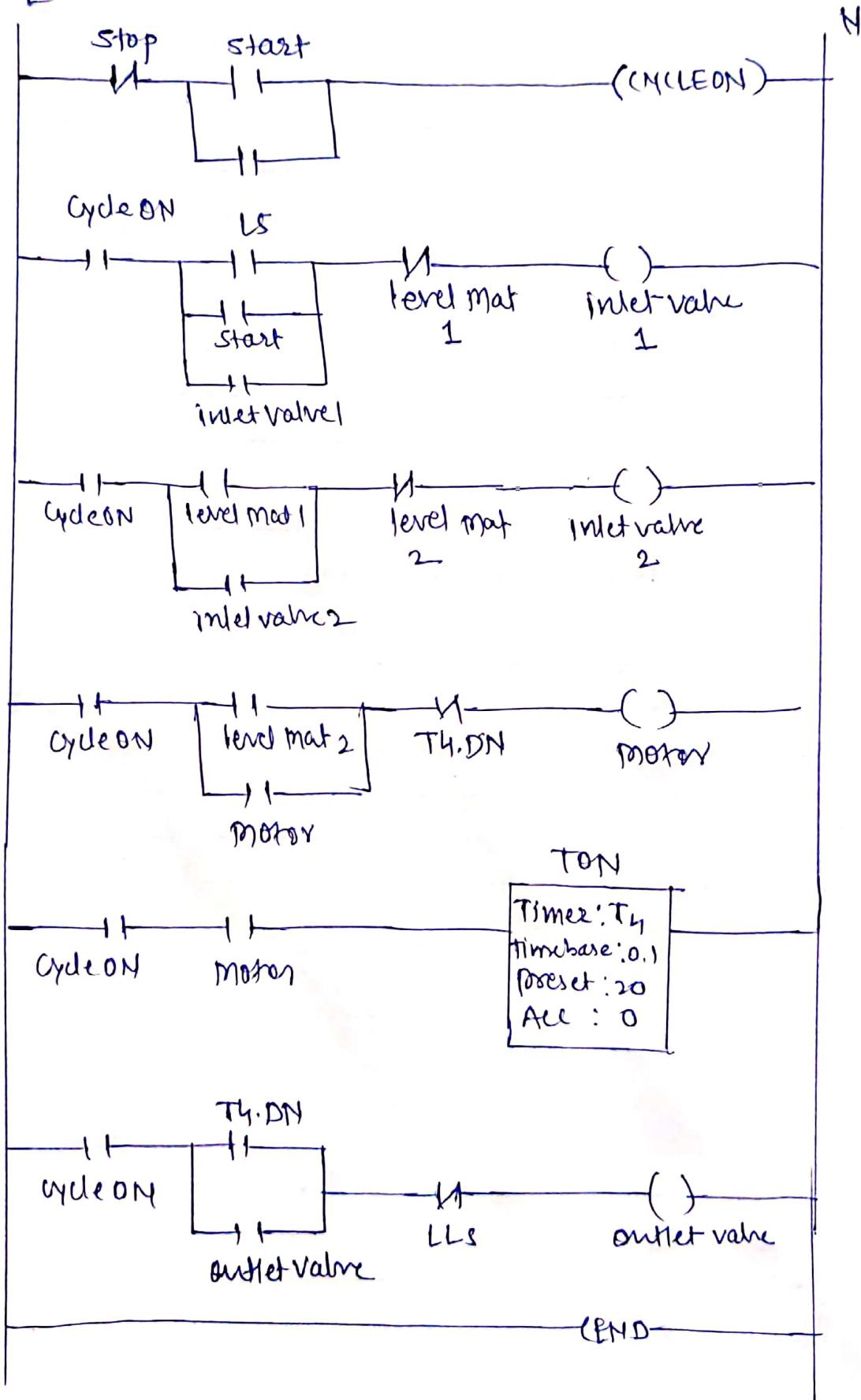
① Symbols

Symbolic representation of the logic function
represented by binary numbers 0 & 1 and
their combinations to denote the state of
various output devices. It is also known as
Machine language of the computer.

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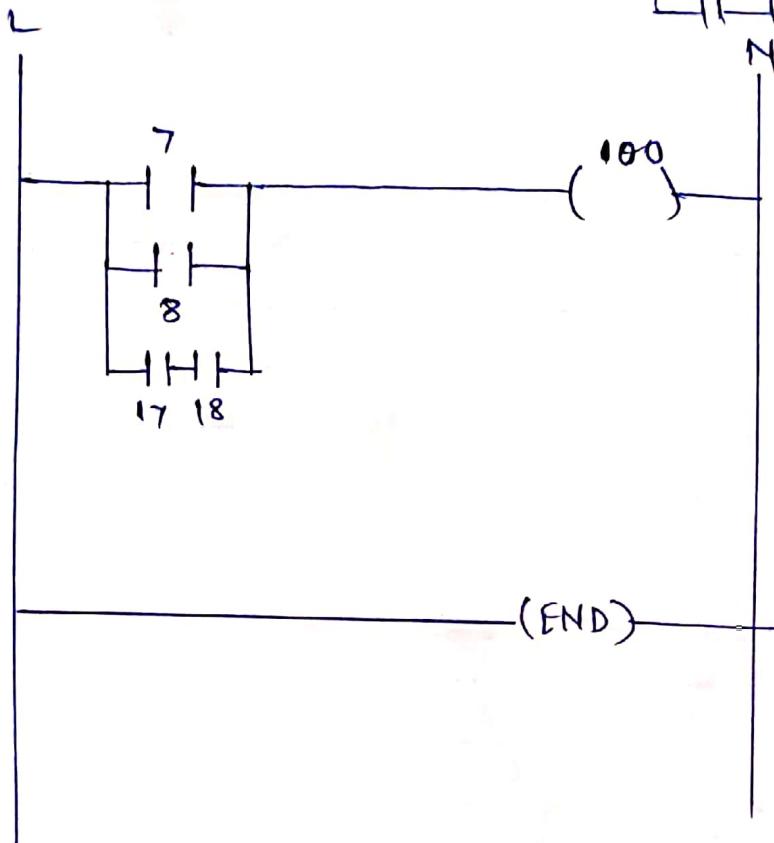


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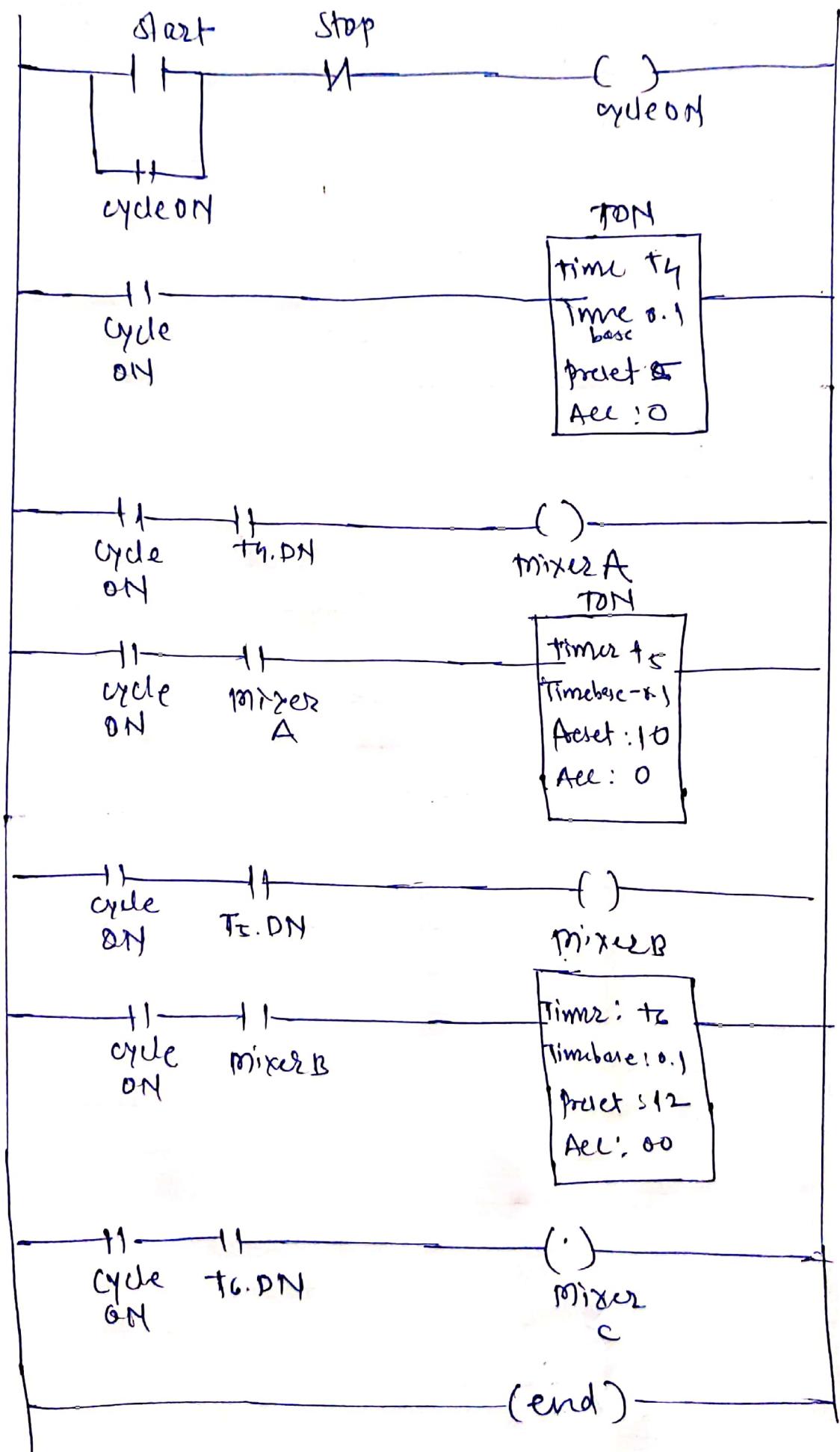
Output 100

input: 7, 8, 17, 18

(7 OR 8) OR (17 AND 18)



(28)



(30)

