IA Question bank - Industrial Automation

Industrial Automation (SRM Institute of Science and Technology)

Question Bank

Industrial Automation

Unit I

1. Sourcing input/output circuit supply current to_____ field device.
   A. Sinking
   B. Digital
   C. Sourcing
   D. Analog

Ans: Sinking

2. Sensor is a device that converts
   A. Electrical signal into physical quantity
   B. Physical quantity into mechanical signal only
   C. Mechanical signal into electrical
   D. Physical quantity into measurable signal

Ans: Physical quantity into measurable signal

3. The father of PLC is
   A. Bill gates
   B. Charles Babbage
   C. DickMorley
   D. Massachusetts

Ans: DickMorley

4. Which of the following is not a part of PLC?
   A. CPU
   B. Memory
   C. Power unit
   D. Relay

Ans:Relay

5. The first company to build PLC was
   A. General motors
   B. Modicon
   C. Allen Bradley
   D. Siemens

Ans:Midicon

6. Relay is a (an) _____ switch
   A. Toggle
   B. Selector
   C. Electromagnetic

D. Electric

Ans: Electromagnetic

7. The _____ is moved towards relay magnet when relay is ON
    A. Armature
    B. Coil
    C. NC contact
    D. NO contact

    Ans :Armature

8. Which of the following cannot be an input to a PLC?
    A. Manual switch
    B. Relay
    C. Sensor
    D. Thermocouple

    Ans: relay

9. Which of the following can be a input of PLC
    A. Sensor
    B. Solenoid
    C. Buzzer
    D. Motor

    Ans: Sensor

10. Choose the function an input module of a PLC
    A. Sense when the signal is received
    B. Isolate the PLC from fluctuation
    C. Sense the input and isolate the PLC from fluctuation
    D. Send the signal to output device

    Ans: Sense the input and isolate the PLC from fluctuation

11. Solenoids, lamps, motors are connected to
    A. Analog output
    B. Digital output
    C. Analog input
    D. Digital input

    Ans: Digital output

12. PLC are designed to operate in the _____ environment

D. Industrial - Answer

13. _____ separates the higher AC input voltage from logic circuits in PLC

A.Diode

B.Optical Isolator - Answer

C.Switch

D.Transistor

14. A high-density discrete I/O module have up to _____ points

A.16

B.32

C.64 - Answer

D.128

15. A PLC which does not require to communicate with other PLCs

A.Stand-alone - Answer

B.Multi task

C.Control management

D.Distributed

16. In discrete output module, _____ is not used as a switching element

A. SCR - Answer

B. Relay

C. Transistor

D. Triac

17. Which of the following is not a standard signal range

A. 0-20mA

B. 4-20mA

C. 10-20mA - Answer

D. 0-10V

18. Which of the following is not relevant to fixed I/O PLC

A. No removable units

B. lower cost

C. divided by compartments

D. lack of flexibility

19. The function of input module in a PLC is

A. Send the signal to output device

B. Sense when the signal is received - Answer

C. Process the input signal

D. Actuate the output signal

20. _____ are designed to operate only when a predetermined limit is reached

A. Toggle switches

B. Push buttons

C. Limit switches - Answer

D. Relays

21. Which of the following device can be a input of PLC

A. Sensor - Answer

B. Solenoid

C. Buzzer

D. Motor

22. The PLC are designed for _____ inputs and _____ output arrangements.

A. Single, Single
B. Single, Multiple
C. Multiple, Single
D. Multiple, Multiple –Ans.

23. The PLC program that executes as part of a repetitive process referred to as a _____.

A. Loop
B. Scan-Ans
C. Closed path
D. Path

Unit II

Sensor is a device that converts

A. Electrical signal into physical quantity

B. Physical quantity into mechanical signal only

C. Mechanical signal into electrical

D. Physical quantity into measurable signal

_____can be pneumatically (air) or hydraulically (liquid) operated switches

A. Pressure switches - Answer

B. Temperature switches

C. Level switches

D. Toggle switches

Which of the following is a manually operated switch

A. Limit switch

B. Thermostat

C. level switch

D. Selector switch - Answer

An example of a discrete control is

(A) Varying the volume of a music system
(B) Varying the brightness of a lamp
(C) Turning ON or OFF a lamp
(D) Controlling the speed of a fan

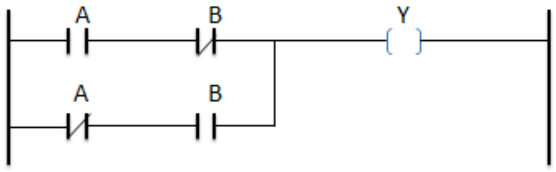
Ans: Turning ON or OFF a lamp

Write the Boolean expression for D

A. D = ABC
B. D = A*B*C'
C. D = A+B'+C
D. D = A+B+C

Ans: D = A*B*C'

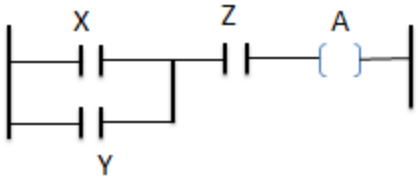
The Boolean expression for Y is



(A) Y = (A+B') (A'+B)
(B) Y = AB' +A'B
(C) Y = AA'+BB'
(D) Y = (A+A')(B+B')

ANS: Y = AB' +A'B

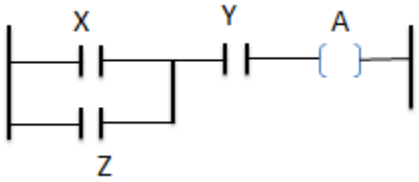
The Boolean expression for A is



(A) A = XZ+Y
(B) A = X+YZ
(C) A = (X+Y)Z
(D) A = XY+Z

Ans: A = (X+Y)Z

The Boolean expression for A is



(A) A = XZ+Y
(B) A = X+YZ
(C) A = (X+Y)Z
(D) A = (X+Z)Y

Ans: A = (X+Z)Y

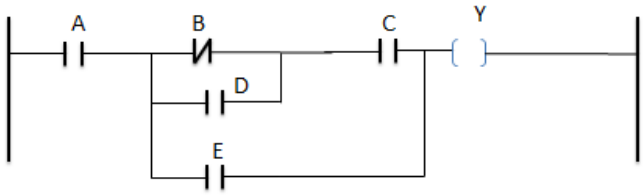
When a relay is not energized

(A) Electrical path establishes through NO contact
(B) Both NO and NC contacts have electrical path
(C) Electrical path establishes through NC contact

(D) Neither NO nor NC contact have electrical path

Ans: Electrical path establishes through NC contact

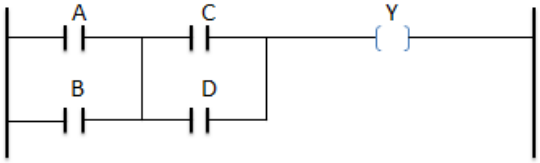
The Boolean expression for Y is



(A) Y = A(B'+D)+(C+E)
(B) Y = A(B'+D+E)C
(C) Y = A(B'+D+C+E)
(D) Y = A((B'+D)C+E)

Ans: Y = A((B'+D)C+E)

The Boolean expression for Y is



(A) Y = (A+C)(B+D)
(B) Y = (BC)+(BD)
(C) Y = (AC)+(BD)
(D) Y = (A+B)(C+D)

Ans: Y = (A+B)(C+D)

Relay is a (an) _____ switch

A. Toggle
B. Selector
C. Electromagnetic - Answer
D. Electric

The _____ is moved towards relay magnet when relay is ON

A. Armature - Answer
B. Coil
C. NC contact
D. NO contact

A _____ is an electrical device that directly converts light in to electricity.

A. Photovoltaic cell - Answer
B. Photoconductive cell
C. Torchlight
D. Battery

Working principle of thermocouple based temperature sensor is

A. Seeback Effect - Answer
B. Hall Effect
C. Piezo Electric
D. Piezo Resistance

Solenoid valves are _____ devices that work by passing an electric current through a solenoid.

A. Electrostatic
B. Electromechanical - Answer
C. Electromagnetic
D. Electrochemical

Identify the symbol

A. Float type level switch - Answer
B. Temperature switch
C. Pressure switch
D. Pressure switch

_____opens the circuit when it is pressed and returns to the closed position when the button is released.

A. Normally closed Pushbutton - Answer
B. Normally opened Pushbutton
C. Break-before-make pushbutton
D. Start Pushbutton

The PLC up-counter increments its accumulated value on

(A) Analog input
(B) Digital input
(C) True to False transition
(D) False to True transition

Ans: False to True transition

Which of the following is not a comparison instruction?

GEQ
EQU
LIM
MOV
Ans: MOV

Which of the following statement is true for a retentive timer?

(A) Accumulates time whenever it receives power
(B) Retains rime when it loses power
(C) Both A and B
(D) Reset tp zero when it loses power

Ans: Both A and B

What is the largest integer number that a PLC counter function can reach if it uses a 16 bit register?

A. 32,768
B. 65,535-ans.
C. 65,536
D. 65,537

Which of the following counts time-based intervals when the instruction transitions from a true to false condition.

A. ON delay timer
B. OFF delay timer
C. Retentive timer
D. Pulse timer

Which of the following counts time-based intervals when the instruction is true and retains the accumulated value when the instruction goes false or when power cycle occurs.

A. ON delay timer
B. OFF delay timer
C. Retentive timer
D. Pulse timer

_____is the value that increments as the timer is timing.

A. preset value
B. accumulated value
C. elapsed value

D. time delay

Which timer operation will keep the output energized for a time period after the rung containing the timer has gone false.

A. ON delay timer
B. OFF delay timer
C. Retentive timer
D. Pulse timer

The _____is incremented by 1 each time the rung containing the counter goes from false to true.

A. Down counter
B. Up counter
C. Retentive timer
D. Pulse timer

The _____decrements by 1 each time the rung containing the counter is energized.

A. Down counter
B. Up counter
C. Retentive timer
D. Pulse timer

The controller has one 20 KHz high-speed counter, which means it would be able to count _____
pulses per second.

A. 2
B. 20
C. 2000
D. **20,000**

The up counter output is false whenever the accumulated value is _____the preset value of the counter

A. Less than
B. Greater than
C. Equal to
D. Equal to or greater than

Select the data type for SR function block input and output variables

A. BOOL
B. INT
C. TIME
D. DINT

What is the output of RS function block when both inputs are TRUE?

A. TRUE
B. FALSE
C. Invalid
D. Not defined

What is the data type for preset values of a TIMER instruction in PLC?

A. BOOL
B. INT
C. TIME
D. DINT

UNIT:3-5

_____ is not the responsibility of plant operator.

Setting up the control system-ans

Monitoring initially

supervising

checking the control system in startup

Select the task for a control system engineer in an automated system

Setting up the control system -Ans

Monitoring initially

supervising

checking the control system in startup

Which of the following is responsible for a plant operator?

Setting up the control system

Monitoring initially -Ans

supervising -ans

control system design

The function of high level computing device of a DCS is

To do closed loop control

To interact with LCU

To interface with process

To perform plant management

Ans: To perform plant management

Which of the following display deal with control loops of a single process unit?

Plant level

Area level

Group level

Loop level

Ans: Loop level

Which of the following architecture has full digital control capability?

Hybrid and Stand alone

Central computer

Distributed

Central computer and Distributed-Ans

How many digital outputs are present in LCU-A configuration?

1

2

3

4

Ans:2

In distributed control system, process variable colour changing concept is called as

Blue-band concept

Red-band concept

Yellow-band concept

Green-band concept

Ans: green-band concept

Recall the number of analog inputs present in LCU-A configuration

1

2

3

4

Ans: 2

_____number of digital outputs are present in LCU -C configuration

32

64

128

256

Ans: 64

How many logic function blocks are present in a LCU- C configuration?

40

160

640

1280

Ans: 1280

In distributed control system, if one site fails

All the sites will stop working

Directly connected sites will stop working

Remaining sites can continue operating

Every system in thenetworks continue operating

Ans: Remaining sites can continue operating

Control complexity ratio of a control system is defined as

$$\frac{Number\ of\ function\ blocks}{Number\ of\ outputs}$$

$$\frac{Number\ of\ outputs}{number\ of\ inputs}$$

$$\frac{Number\ of\ outputs}{Number\ of\ function\ blocks}$$

$$\frac{Number\ of\ function\ blocks}{Number\ of\ inputs}$$

Ans:$\frac{Number\ of\ function\ blocks}{Number\ of\ outputs}$

A device that allows the operator to interact with LCU is called

High level human interface

General purpose computer

Local control unit

Low level human interface

Ans: Low level human interface

How many continuous function blocks are there in LCU-C configuration

640

1280

40

160

Ans:640

Choose the location of the LCU's in a standalone control configuration

Plant area

Equipment room-ans

Control room

Server room

Choose the location of low level human interface in a centralized control configuration

Plant area

Equipment room

Control room-Ans

Server room

Choose the location of low level human interface in a distributed control configuration

Plant area-Ans

Equipment room

Control room

Server room

Choose the location of high level human interface in a distributed control configuration

Plant area

Equipment room

Control room-Ans

Server room

Choose the location of high level human interface in a centralized control configuration

Plant area

Equipment room

Control room-Ans

Server room

Choose the location of LCU's in a distributed control configuration

Plant area-ans

Equipment room

Control room

Server room

Select an example of a logical process variable

Flow

Temperature

Pressure

Pump On/Off-Ans

Select the example(s) of a continuous process variable

(A) Flow-Ans
(B) Temperature-Ans
(C) Pump On/Off
(D) Valve open/close

Choose the basic function of the operator interface system

Process monitoring-ans

Process control

Process record keeping

Process diagnostics

The history of selected process variables in the plant are called_____

Set point

Controlled variable

Trended variable-ans

Tags

The operator interface system allows the operator to identify the equipment faults is called as _____

Process monitoring

Process control

Process record keeping

Process diagnostics-ans

Which of the following does not belong to the low level operator interface?

Continuous control station

Logic station

Indicator station

Peripherals-Ans

Which of the following belong to the low level operator interface?

Continuous control station-ans

Logic station-ans

Peripherals

Keyboard

Which of the following belong to the high level operator interface?

Continuous control station

Logic station

Peripherals-ans

Keyboard-ans

Which of the following is the primary function of the high level operator interface?

To allow communications between the operator and the automated system-ans

To monitor the process

To control the process

To keep the record of events

In a display hierarchy, which of the following level provide information concerning the entire plant?

Plant level-ans

Area level

Group level

Loop level

In a display hierarchy, which of the following level provide information concerning the portion of the plant equipment?

Plant level

Area level-ans

Group level

Loop level

In a display hierarchy, which of the following level deal with the control loops and data points relating to a single process unit?

Plant level

Area level

Group level-ans

Loop level

Which of the statement is not to be considered while designing a display unit?

Displays should not be cluttered

Displays should be overly flashy-ans

Color should not be the sole means for communicating alarm conditions.\

Displays should not have light colored backgrounds

An operator interface should be designed in such a way that the operator performs the particular task effectively with minimal error; this is in short referred to as---- of the system

Economics
Error minimisation
Ergonomics-ans
Efficiency

In order to ensure safe backup of critical information, one of the following step is preferred

Identify only critical parameters to be backed up
Run from a redundant power supply-ans
Store relatively less amounts of data
Inform the operator on loss of data

Identify the hardware element in a process that is needed for alerting the operator.
Controller
Annunciator-ans
Actuator
Error detector

Indicate the type of display that is not applicable to DCS setup.
Group level display
Plant level display
Area level display
Module level display-ans

DCS setup is a control configuration which is geographically distributed and functionally separated across the plant. In this statement, the term "functionally" refers to------
Logic functions
Control commands-Ans
Interface commands
Manual functions

A High Level Operator Interface accepts inputs through/by means of----
Plungers
Push buttons
Keyboards-ans
All of the above

Identify the foremost step that needs to be initiated in case of multi loop failures in a process.
Multiple alarms-Ans
Immediate shutdown of the entire plant
Data backup
Manual to Auto changeover

Process monitoring and record keeping are primary functions of-----
Low level Engineering Interface
High level Engineering Interface
Low level Operator Interface-ans
High level Operator Interface

The primary purpose of the LLEI is to
Alert the operator on any malfunctioning in the process
Configure and implement the control algorithms -Ans

Perform signal conditioning on a particular process output
Initiate set points to control a particular process

_____ is a type of feedback mechanism used while pressing pushbuttons
LED
Display pane
Buzzer
Tactile -ans

Identify the FALSE statement among the following.
Operator interfaces allow the operator to take logical control actions
Operator interfaces allow closed loop control of processes-ans
Operator interfaces helps to indicate any malfunctioning within a process
Engineering Interfaces not are user friendly

Identify the sequence that is NOT applicable to process diagnostics
Self test on devices before start up
Routine maintenance checks on sensors
First out and priority alarming
Record of short term trending information-ans

A Group level display is meant for----
Batch sequences-ans
X-Y trends
Alarm summary
Tuning display

Arrange the sequence of alarm initiation in the correct order (from beginning to end)
A. Operator acknowledgment B. Occurrence of a fault C. Alarm switch is inactive
D. Alarm/Siren is enabled E. Alarm switch is active
E-A-B-D-C-E
B-E-D-B-A-C
C-B-E-D-A-C-ans
E-B-D-A-C-E

Auto/Manual switchover is often referred to as ----control
Independent
Override-ans
Dependent
Dual

Indicate the design consideration that needs to be avoided in operator displays
Displays should be overly flashy so that it attracts attention-ans
Displays should have bright coloured backgrounds
Displays should not be cluttered

Displays should not be inept

Power system diagnostics is carried out ----
- At regular intervals
- During startup/shutdown
- Continuously throughout -ans
- During Shift changeovers

Process diagnostics to be implemented in a complicated process comprising of more than 5000 process variables should include --------
- Auto/manual changeover
- Sophisticated alarming system-ans
- Automatic shutdown
- Manual data backup

A_____ display provide high resolution and better visibility in bar graphs.
- Glass discharge
- Gas discharge-ans
- Argon Gas
- Neon gas

In a particular process with more than 1000 control loops, which of the following step would you suggest in order to safeguard the data
- Include more numbers of HLOI
- Include more numbers of LLOI for redundancy
- Divide the loops equally among all the HLOI
- Implement overlap control among the available HLOI-ans

Identify the drawback of Low Level Engineering Interface among the following statements
- LLEI consists of small number of panel board devices
- LLEI are expensive and difficult to implement
- Connections are done by means of hardwiring/cabling-ans
- Documentation is not possible

Suggest a suitable solution to avoid confusions in a complex process
- Provide tag name /descriptors-ans
- Separate all identical processes
- Isolate critical and less critical process
- Detailed labelling of variables

Bell 202 FSK standard uses _____ frequencies

1200 Hz and 2000Hz

1000 Hz and 2000 Hz

1200 Hz and 2200 Hz

1000 Hz and 2200 Hz

Ans : 1200 Hz and 2200 Hz

Field bus is _____ communication system

Digital, serial, one-way

Analog, serial. One-way

Digital, serial two-way

Analog, serial, two-way

Ans : Digital, serial two-way

Baud rate of bell 202 standard is

1200

2200

1024

9600

Ans:1200

In intrinsically safe application, maximum how many devices can be connected to a single multi drop cable pair?

(A) 1
(B) 2
(C) 4
(D) 5

Ans: 4

What is the minimum amplitude of HART slave transmitted signal?

0.4 mAp-p
0.4 mV p-p
0.8 mA p-p
0.8 mVp-p

Ans: 0.8 mA p-p

_____number of slave devices can be connected to a single multi drop cable pair in HART

(A) 10
(B) 13

(C) 15
(D) 20
Ans: 15

HART uses_____ communication standard
Bell 102
Bell 202
Bell 302
Bell 402
Ans: Bell 202

In HART message structure, what is the maximum data size?
(A) 15 Bytes
(B) 10 Bytes
(C) 25 Bytes
(D) 50 Bytes
Ans: 25 Bytes

Minimum preamble size of HART message structures is

(A) l byte
(B) 5 bytes
C) 3 bytes
(D) 7 bytes
Ans: 5 Bytes

What is the maximum peak to peak amplitude of HART master transmitted signal?
400mV
600mV
800mV
900mV
Ans : 600mV

When was the first DCS introduced in the market *
1960
1965
1975-Ans
1980

Which of the following interfaces with other devices in DCS only over the shared communication medium *
Local control unit
High level human interface

High level computing device
High level human interface and computing device-Ans

Which of the following refers to the power and flexibility of the control algorithms that can be implemented by the system *
A)Scalability and expandability
B) Control capability-Ans
C)Operator interfacing capability
D)Maintainability

Name the control system architecture which is very sensitive to single point failure *
A) Central computer architecture-Ans
B) Hybrid system architecture
C) DCS architecture
C) Hybrid and DCS architecture

Which of the following refers to the number of function blocks that can be executed by the controller *
A)Functionality of the controller
B) Size of the controller-Ans
C)Performance of the controller
D) Controller output

Which of the following refers to the rate at which the controller scans input, process the function block and generate outputs. *
A)Functionality of the controller
B) Size of the controller
C)Performance of the controller-Ans
D) Controller output

Which of the following control system architecture has full digital control capability *
A) Hybrid system architecture
B) Central computer architecture
C) DCS architecture
C) DCS and central computer architecture-Ans

Name the device that interface to the process solely for the purpose of acquiring or outputting data *
A)Local control unit
B) Low level human interface
C)High level human interface
D)Data input and output unit-Ans

The station that has a definition of entire process is *

(A) Remote terminal unit
(B) Operator interface
(C) Master terminal unit-Ans
(D) Local control unit

DCS setup is a control configuration which is geographically distributed and functionally separated across the plant. In this statement, the term “functionally” refers to------ *
Logic functions
Control commands-Ans
Interface commands
Manual functions

Suggest a suitable solution to avoid confusions in a complex process *
Provide tag name /descriptors-Ans
Separate all identical processes
Isolate critical and less critical process
Detailed labelling of variables

In order to ensure safe backup of critical information, one of the following step is preferred *
Identify only critical parameters to be backed up
Run from a redundant power supply-Ans
Store relatively less amounts of data
Inform the operator on loss of data

When was the first PLC introduced to implement sequential logic control system *
1950
1960
1970-Ans
1980

Select the company which introduced first DCS in the market *
ABB
Centum-Ans
Siemens
Honeywell

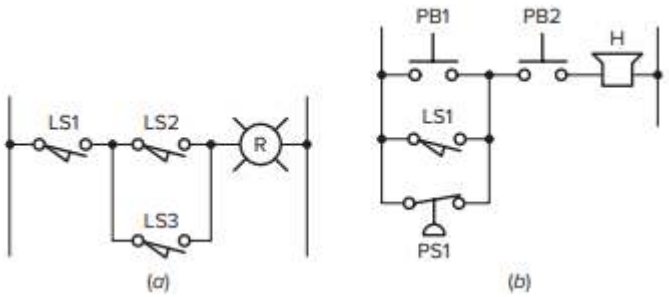
UNIT 1&2

1. List any four distinct advantages that PLCs offer over conventional relay-based control systems
2. State two ways in which I/O is incorporated into the PLC.
3. Explain the main function of each of the major components of a PLC
4. Outline the sequence of events involved in a PLC scan cycle.
5. Summarize how reed switch sensors are actuated?
6. Name the three forms of PLC counter instructions, and explain the basic operation of each
7. Describe briefly about the construction and working principle of a relay and solenoid valve.
8. Describe briefly about the various parts of a PLC
9. Draw the electrical symbol used to represent each of the following switches:
   a. NO pushbutton switch
   b. NC pushbutton switch
   c. Break-make pushbutton switch
   d. Three-position selector switch
   e. NO limit switch
   f. NC temperature switch
10. a)Compare the PLC and PC with regard to: i. Physical hardware differences ii. Operating environment iii. Method of programming iv. Execution of program
    b) Compare the single-ended, multitask, and control management types of PLC applications

11. Express each of the following equations as a ladder logic program:

a. $Y = (A + B)CD$
b. $Y = A\overline{B}C + \overline{D} + E$
c. $Y = [(\overline{A} + \overline{B})C] + DE$
d. $Y = (\overline{A}B\overline{C}) + (D\overline{E}F)$

12. Write the ladder logic program, draw the logic gate circuit, and state the Boolean equation for the two relay ladder diagrams in Figure



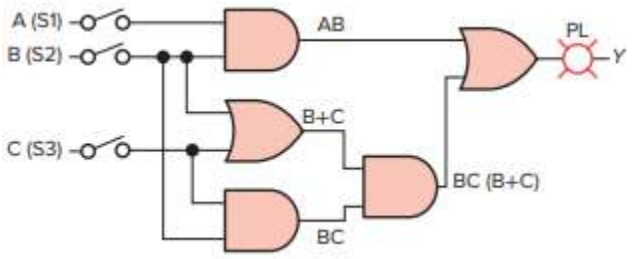
13. It is required to have a pilot light come on when all of the following circuit requirements are met:
    • All four circuit pressure switches must be closed.
    • At least two out of three circuit limit switches must be closed.
    • The reset switch must not be closed.

    Using AND, OR, and NOT gates, design a logic circuit that will solve this hypothetical problem and also draw the ladder program.

4. For the logic gate circuit shown in Figure,

a. Determine the Boolean equation.

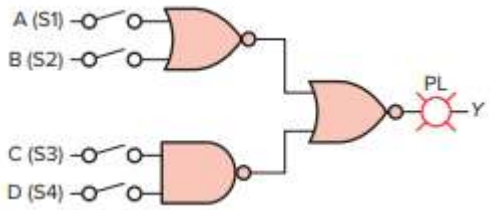
b. Draw an equivalent ladder logic program for the gate circuit.



5. For the logic gate circuit shown in Figure,

a. Determine the Boolean equation.

b. Draw an equivalent ladder logic program for the gate circuit.



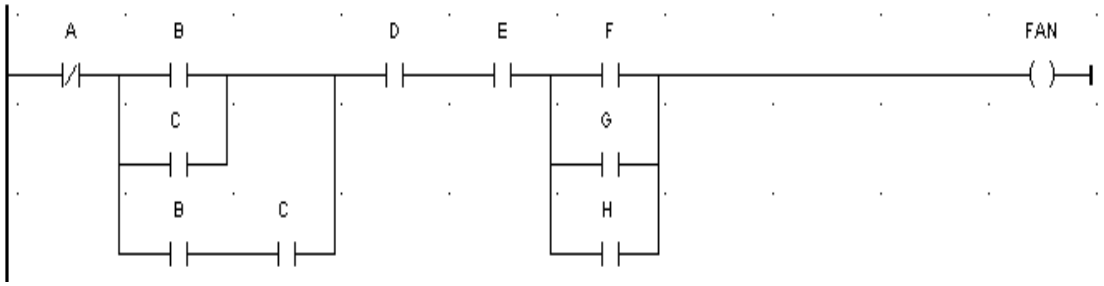
6. Write the Boolean expression and draw the gate logic diagram and typical PLC ladder logic diagram for a control system wherein a fan is to run only when all of the following conditions are met:

• Input A is OFF

• Input B is ON or input C is ON, or both B and C are ON

• Inputs D and E are both ON

• One or more of inputs F, G, or H are ON

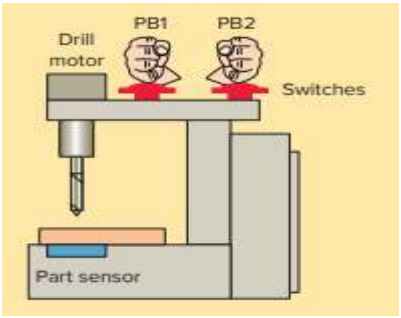


7. Outline the sequence of events involved in a PLC scan cycle.

8. List the five standard PLC languages as defined by the International Standard for Programmable Controllers, and give a brief description of each.

9. A normally closed pushbutton is connected to a PLC discrete input. Does this mean it must be represented by a normally closed contact in the ladder logic program? Explain why or why not.

10. Figure shows the sketch of a drilling process that requires the drill press to turn on only if there is a part present and the operator has one hand on each of the start switches. This precaution will ensure that the operator's hands are not in the way of the drill. The sequence of operation requires that switches 1 and 2 and the part sensor all be activated to make the drill motor operate. Develop the ladder logic program required for the process.



11. Figure shows the sketch of a continuous filling operation. This process requires that boxes moving on a conveyor be automatically positioned and filled. The sequence of operation for the continuous filling operation is as follows:

• Start the conveyor when the start button is momentarily pressed.

• Stop the conveyor when the stop button is momentarily pressed.

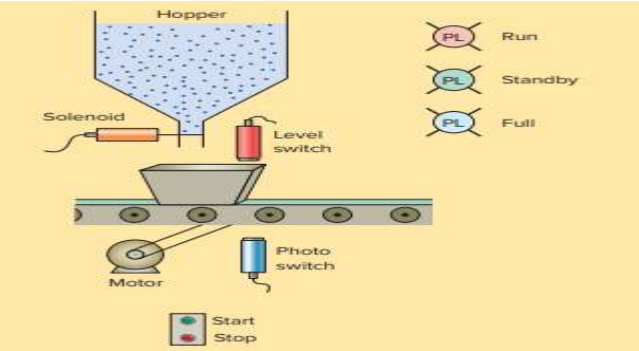
• Energize the run status light when the process is operating.

• Energize the standby status light when the process is stopped.

• Stop the conveyor when the right edge of the box is first sensed by the photo sensor.

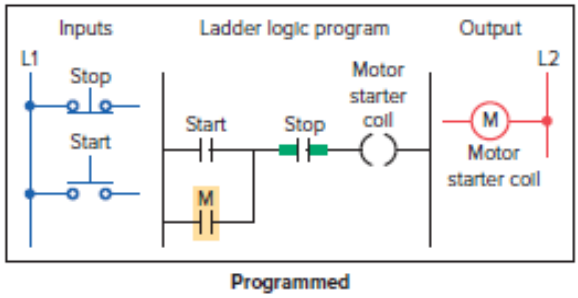
• With the box in position and the conveyor stopped, open the solenoid valve and allow the box to fill. Filling should stop when the level sensor goes true.

• Energize the full light when the box is full. The full light should remain energized until the box is moved clear of the photo sensor.



12. What is a seal-in circuit?

It is a method of maintaining current flow after a momentary switch has been pressed and released



Programmed

13. A temperature control system consists of four thermostats controlling three heating units. The thermostat contacts are set to close at 50°, 60°, 70°, and 80°F, respectively. The PLC ladder logic program is to be designed so that at a temperature below 50°F, three heaters are to be ON. From 50° to 60°F, two heaters are to be ON. For 60° to 70°F, one heater is to be ON. Above 80°F, there is a safety shutoff for all three heaters in case one stays on because of a malfunction. A master switch is to be used to turn the system ON and OFF. Prepare a typical PLC program for this control process.

14. A pump is to be used to fill two storage tanks. The pump is manually started by the operator from a start/stop station. When the first tank is full, the control logic must be able to automatically stop flow to the first tank and direct flow to the second tank through the use of sensors and electric solenoid valves. When the second tank is full, the pump must shut down automatically. Indicator lamps are to be included to signal when each tank is full. a. Draw a sketch of the process. b. Prepare a typical PLC program for this control process.

15. Design a PLC program and prepare a typical I/O connection diagram and ladder logic program for the following motor control specifications: • A motor must be started and stopped from any

one of three start/stop pushbutton stations. • Each start/stop station contains one NO start pushbutton and one NC stop pushbutton. • Motor OL contacts are to be hardwired.

16. a. Explain the difference between the operation of a nonretentive timer and that of a retentive timer. b. Explain how the accumulated count of programmed retentive and nonretentive timers is reset to zero.

17. Write a ladder logic program that will turn on a light, PL, 15 s after switch S1 has been turned on.

18. Write a program to implement the process illustrated in Figure. The sequence of operation is to be as follows:

• Normally open start and normally closed stop pushbuttons are used to start and stop the process.

• When the start button is pressed, solenoid A energizes to start filling the tank.

• As the tank fills, the empty level sensor switch closes.

• When the tank is full, the full level sensor switch closes

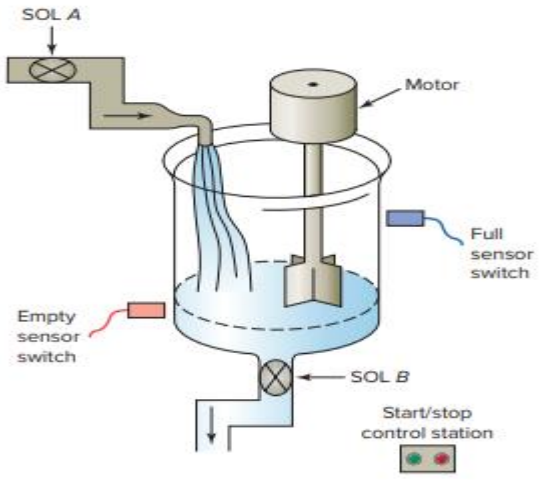
• Solenoid A is de-energized.

• The agitate motor starts automatically and runs for 3 min to mix the liquid.

• When the agitate motor stops, solenoid B is energized to empty the tank.

• When the tank is completely empty, the empty sensor switch opens to de-energize solenoid B.

• The start button is pressed to repeat the sequence.



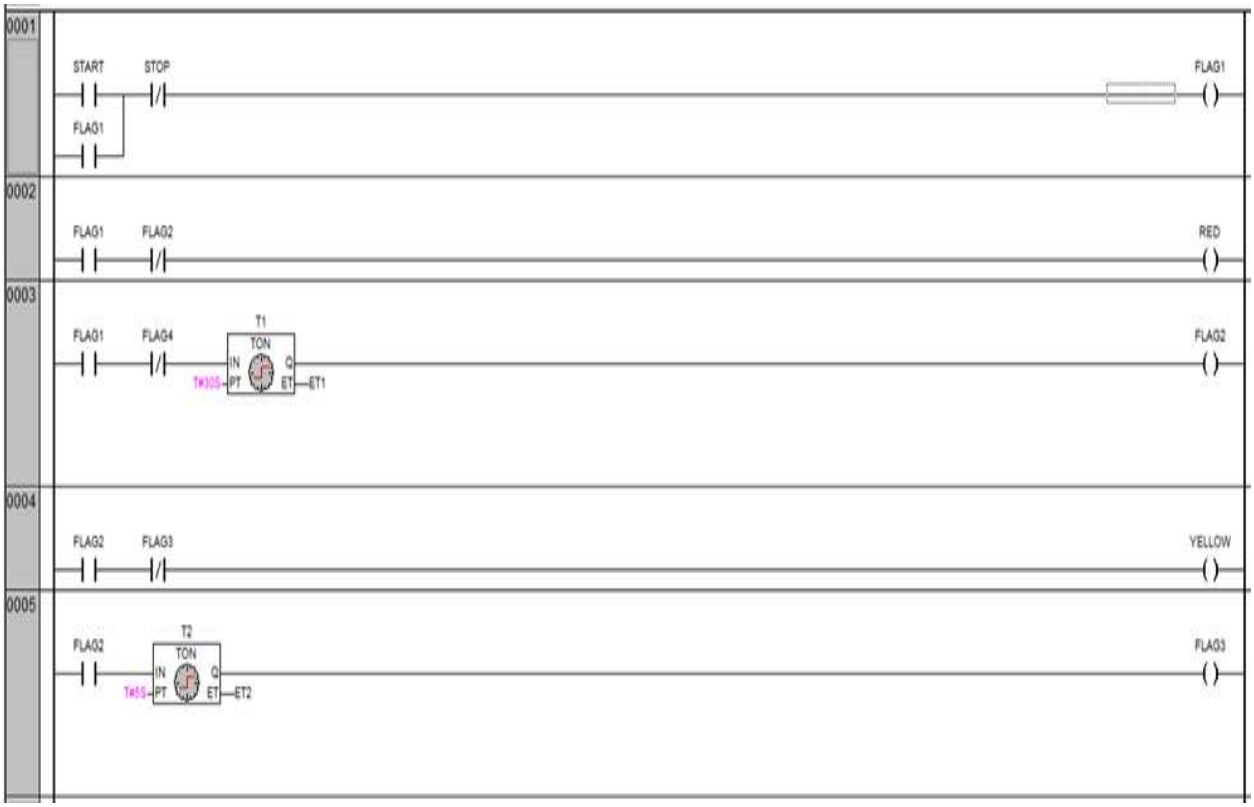
19. When the lights are turned off in a building, an exit door light is to remain on for an additional 2 min, and the parking lot lights are to remain on for an additional 3 min after the door light goes out. Write a program to implement this process.

20. Name the three forms of PLC counter instructions, and explain the basic operation of each.

21. When is the output of a PLC counter energized?

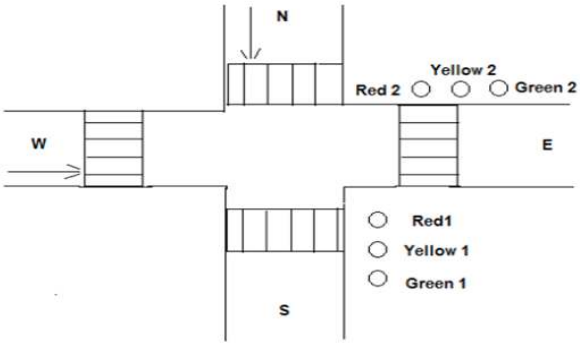
22. Write a program that will increment a counter's accumulated value 1 count every 60 s. A second counter's accumulated value will increment 1 count every time the first counter's accumulated value reaches 60. The first counter will reset when its accumulated value reaches 60, and the second counter will reset when its accumulated value reaches 12.

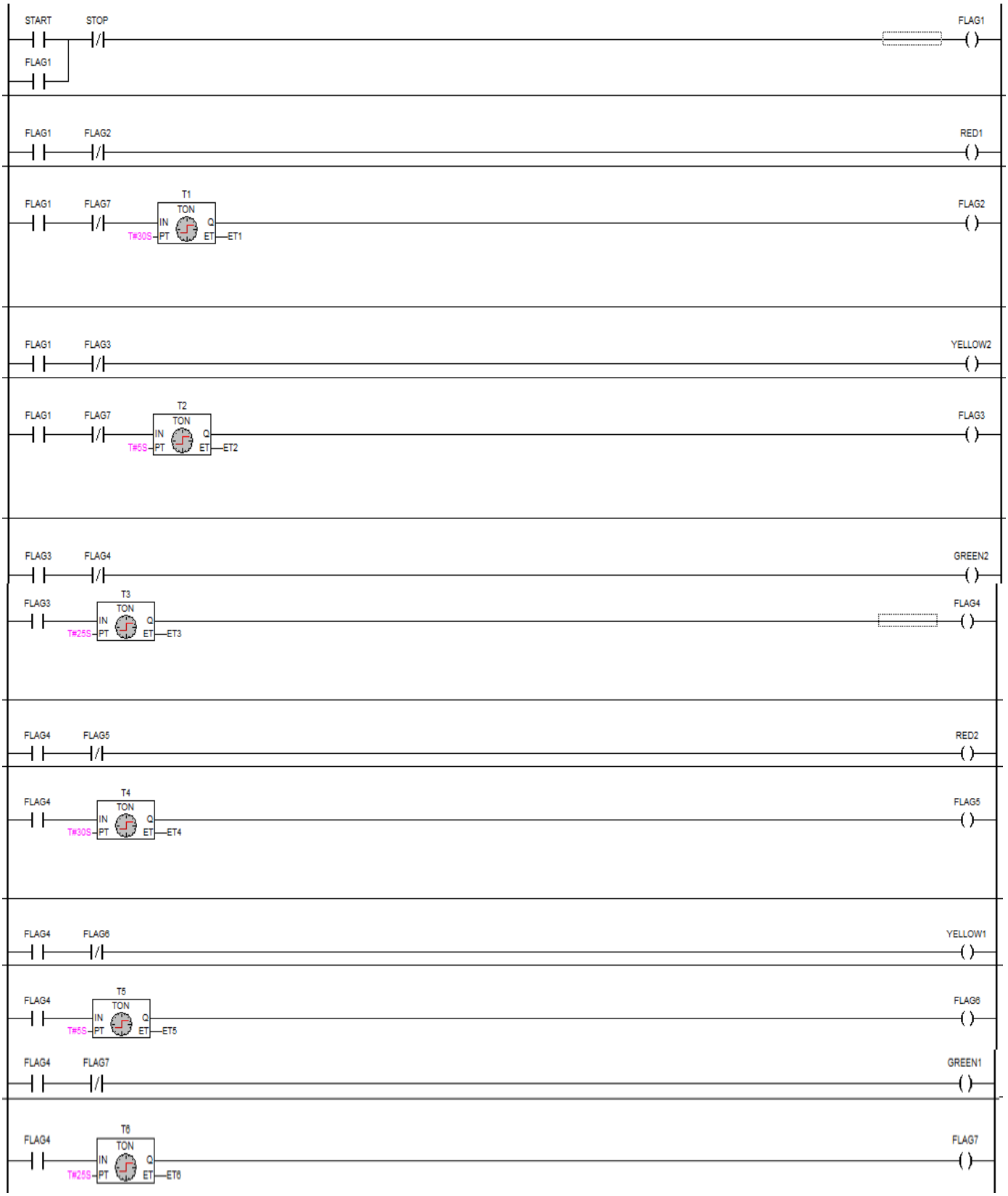
23. Develop the ladder diagram for a one way traffic light control system. When start button is pressed, Red light will be ON for 30s after which yellow light is ON for 5s then green light is ON for 25s and this process continues. There is a start and stop button to control the system.



24. When Red 1 is ON for 30s, E-W traffic flows. At this instant, Yellow 2 becomes ON for 5s after which Green 2 becomes ON for 25s. After 30s, when Red 2 is ON for 30s, N-S traffic flows. At this instant, Yellow 1 becomes ON for 5s after which Green 1 becomes ON for 25s and this process continues. There is a start button and a stop button. Draw the ladder logic to implement the above process.

Flow diagram:





25. Write a PLC program to operate a light according to the following sequence.

- A momentary push button is pressed to start the sequence
- The light is switched ON and remains ON for 2 s.
- The light is then switched off and remains off for 2 s.
- A counter is incremented by 1 after this sequence.
- The sequence then repeats for a total of 4 counts.
- After the fourth count, the sequence will stop and the counter will be reset to zero.

26. Three conveyors feed a main conveyor. The count from each feeder conveyor is fed into an input register in the PLC. Construct a PLC program to obtain the total count of parts on the main conveyor. Use a timer to update the total every 15 seconds. Design, construct, and test PLC circuits for this process

27. In certain process control application o/p is ON if the count is less than 34 or more than 41. Implement the same using PLC ladder diagram

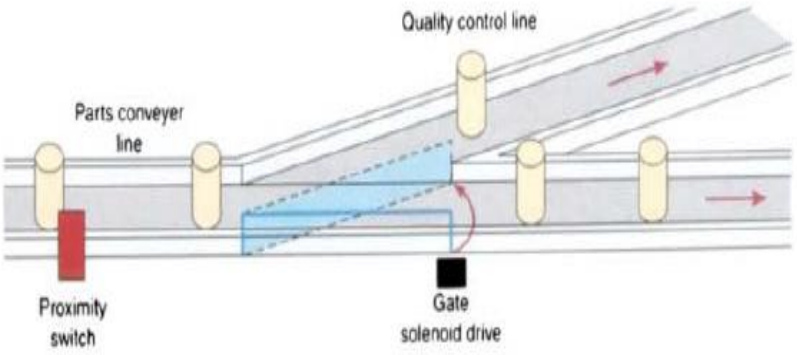
28. An indicating light is to go ON when a count reaches 23.The light is then go off when a count of 31 is reached. Design, construct, and test PLC circuits for this process

29. In certain process control application when the count reaches 25, a paint spray is to run for 40 seconds. Design, construct, and test PLC circuits for this process.

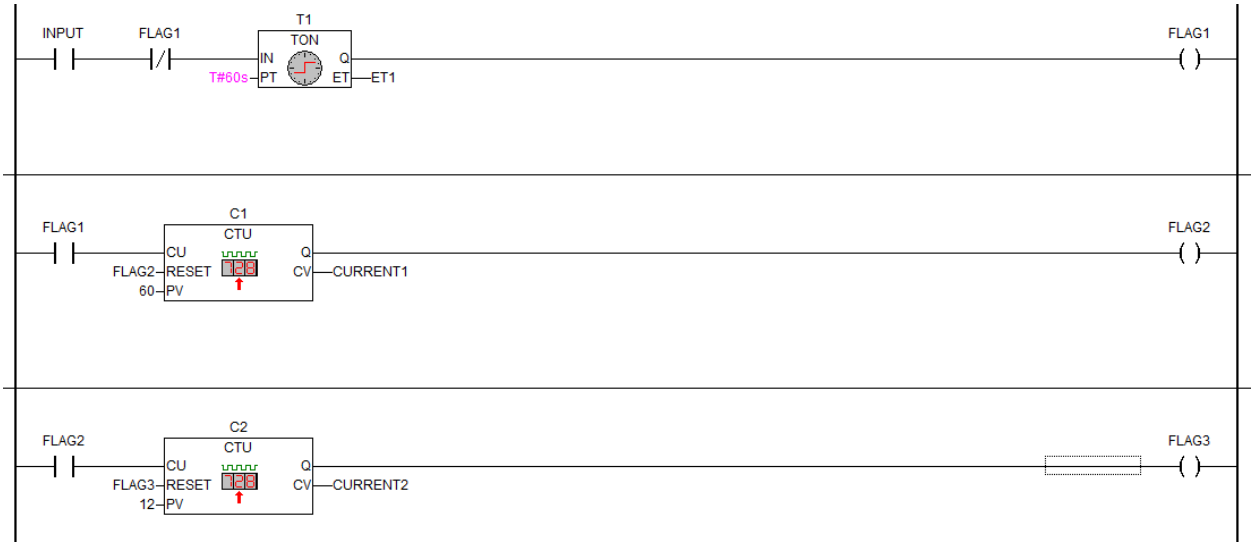
30. Write a program to implement the process illustrated in Figure below. An up-counter must be programmed as part of a batch-counting operation to sort parts automatically for quality

control. The counter is installed to divert 1 part out of every 1000 for quality control or inspection purposes. The circuit operates as follows:

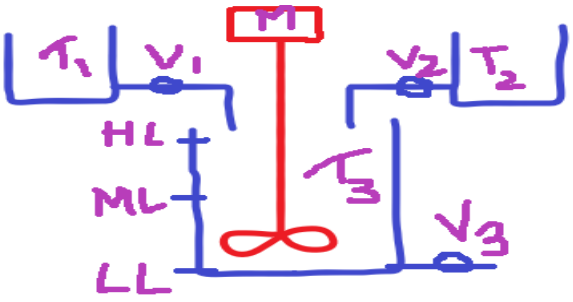
- A start/stop pushbutton station is used to turn the conveyor motor on and off.
- A proximity sensor counts the parts as they pass by on the conveyor.
- When a count of 1000 is reached, the counter's output activates *the* gate solenoid, diverting the part to the inspection line.
- The gate solenoid is energized for 2 s, which allows enough time for the part to continue to the quality control line.
- The gate returns to its normal position when the 2-s time period ends.
- The counter resets to 0 and continues to accumulate counts.
- A reset pushbutton is provided to reset the counter manually.

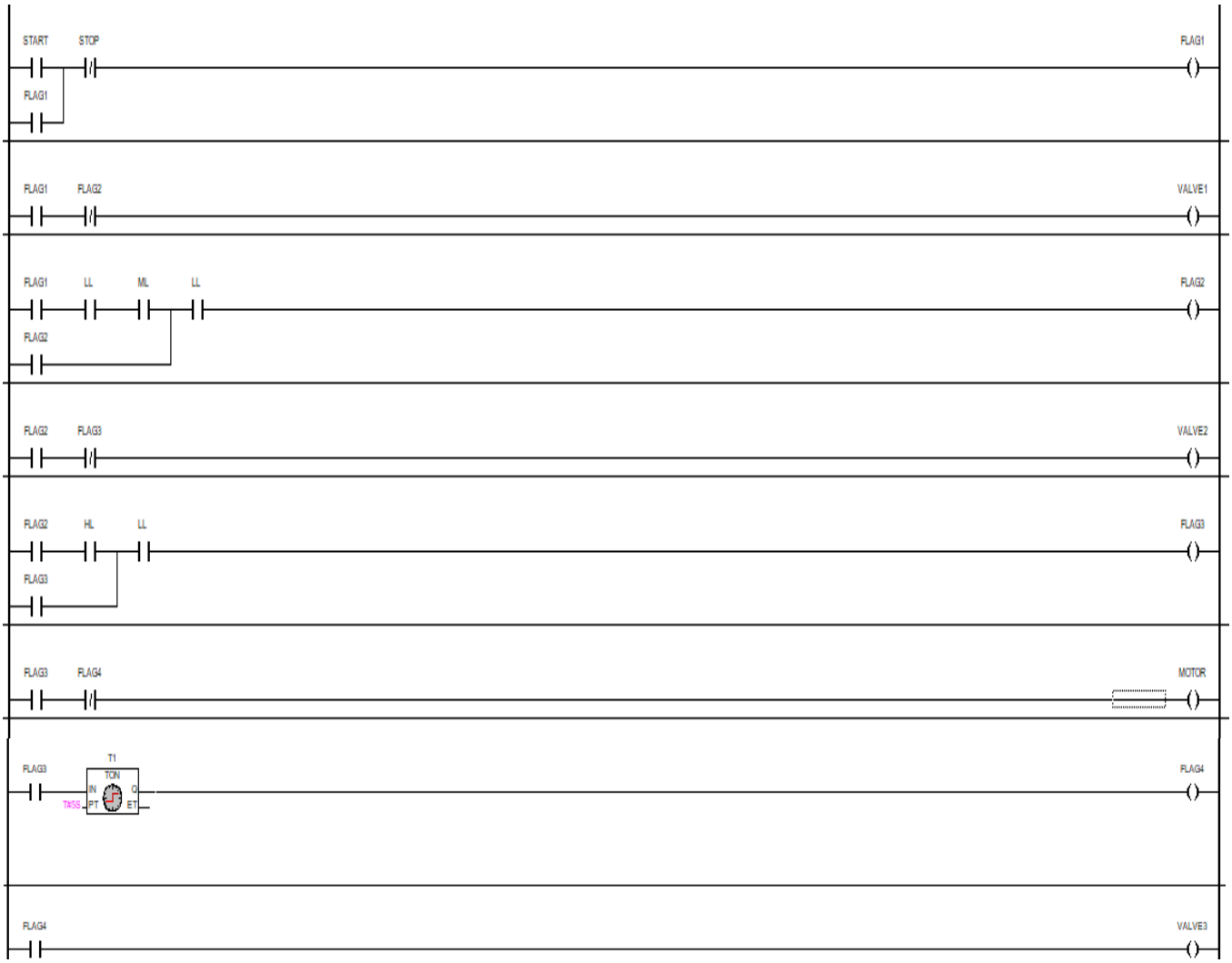


31. Write a program that will increment a counter’s accumulated value 1 count every 60 s. A second counter’s accumulated value will increment 1 count every time the first counter’s accumulated value reaches 60. The first counter will reset when its accumulated value reaches 60, and the second counter will reset when its accumulated value reaches 12.



32. When START is pressed the valve V1 will get ON resulting liquid1 inlet to mixing tank. As liquid1 comes in low level sensor will get ON and further middle level sensor will be ON. As ML is ON, V1 should get OFF and V2 should get ON. As V2 is ON liquid 2 inlet to mixing tank resulting increase in level and reaches to high level sensor. As HL is ON V2 will get OFF and motor M will get ON for 10s. After 10s, motor gets OFF and drain V3 gets ON. As drain is ON mixing tank will start getting empty. Slowly level goes down resulting HL, ML and LL sensors OFF one by one. As LL is OFF repeat the process. STOP button will be used to stop the process at any time.





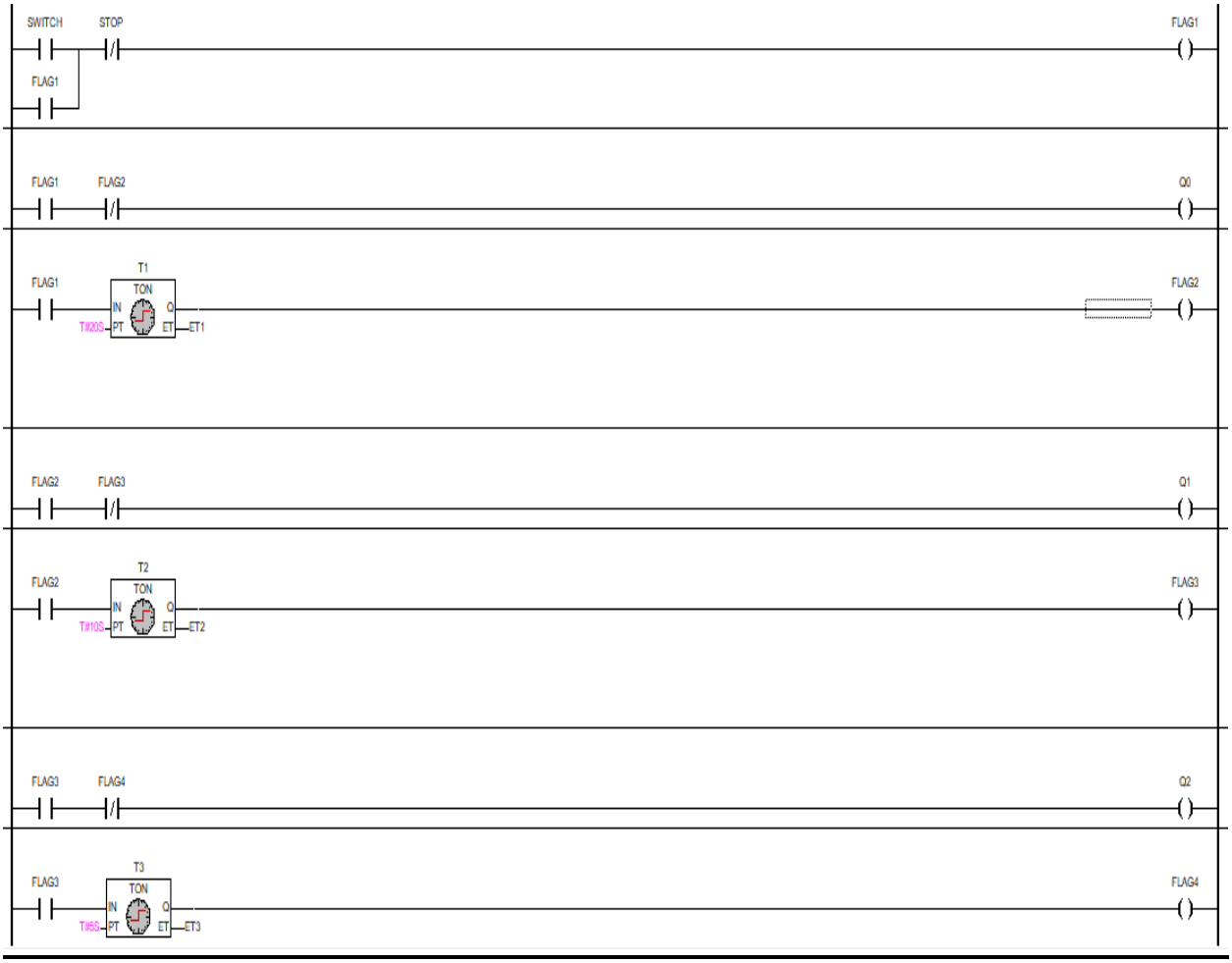
33. There are 3 pumps on a processing line which are operated in a following sequence.

When START button is pressed pump1 should get ON for 20sec. Next pump2 should get ON for 10sec. Next pump 3 should get ON for 5 sec. Write PLC ladder diagram, and realize the same.

There are 2 inputs(start and stop)

Inputs : I0 and I1

Outputs: Q0, Q1 and Q2



UNIT-3&4

1. Describe briefly about the computer based control system developments
2. Compare different control system architectures on its features
3. Explain the function block programming approach with an example
4. List the basic elements of a local control unit
5. Recall the use of function blocks in programming LCU
6. Define control complexity ratio of a control system structure.
7. Describe briefly about the architecture of a DCS
8. Explain the architectural parameters of LCU and compare its different configurations.

9. Compare various configuration of LCUs on its architectural parameters.
10. Draw the configuration-A architecture of an LCU
11. Draw the configuration-B architecture of an LCU
12. Draw the configuration-C architecture of an LCU
13. List few logic functions used in a function block
14. List few signal processing functions used in a function block
15. List few computational functions used in a function block
16. List few signal status functions used in a function block
17. Summarize the security design issues for the local control unit
18. Illustrate how LCU interface to distributed system elements.
19. Explain the design considerations and requirements of operator interface in detail.
20. Identify and analyze the requirement for engineering interface.
21. List the types of displays used in process plant at different hierarchy level.
22. Sketch the architecture of geographically centralized control configuration.
23. Enumerate the need for a Human Machine Interface and highlight upon its requirements.

UNIT-5

24. Explain the different types of Fieldbus topology with neat diagram.
25. Discuss the features of HART protocol based on (i) communication modes and (ii) command structures.
26. Examine the important capabilities in the selection of HART protocol.
27. Write the important features of HART protocol and represent its frame format.
28. Define the terms Interoperability and Inter changeability. Indicate 2 main components of interoperability
29. Discuss briefly about HART Networks & Commands
30. Discuss briefly about Field Bus reference Model