



IQRA National University, Peshawar
Department of Electrical Engineering
Spring 2020
Elective 5 (Power).
Elective 4 (Electronics).
Industrial Electronics
Terminal Examination

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Total Marks : 50

Attempt All Questions.

Question No 1.

10

- A. Consider a lubricating oil tank in Industrial Plant having 2 sensors, one is put near to the bottom and one near to top, to fill the tank, motor A will pump oil to tank until the high level sensor turns on, at that point the motor A turns OFF. Motor A is turned ON when the level fall below the low level sensor. Explain the states of PLC operating cycle with help of neat ladder diagrams. **CLO-3**
-

Question No 2

20

- A. Write some benefits of Industrial Automation **CLO-2**
B. Briefly explain the components and functions of SCADA system **CLO-2**
-

Question No 3

20

- A. Differentiate between Hardwired control systems and PLC system **CLO-3**
B. What are the function of SCADA systems **CLO-2**

.Good Luck.

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Q#1(A)

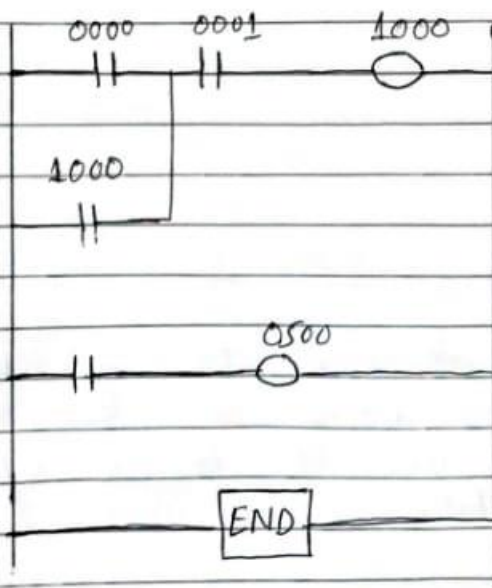
Solution:-

<u>Input</u>	<u>Address</u>
low level sensor	0000
High level sensor	0001

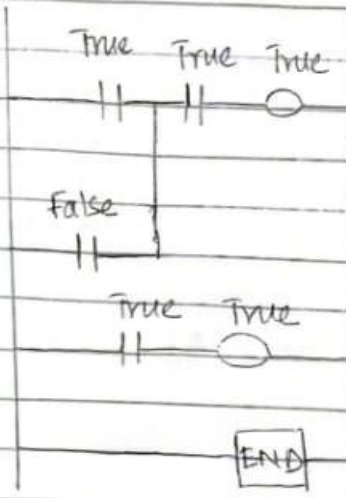
<u>Output</u>	<u>Address</u>
Motor	0500

Internal Utility Relay
1000

"The ladder diagram"

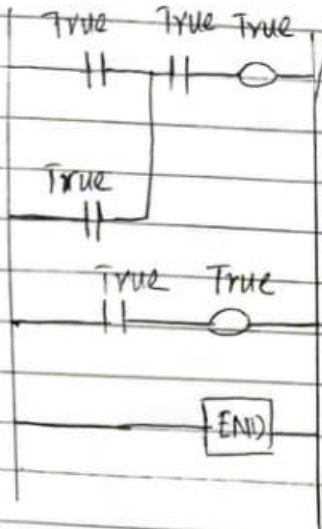


Scan (1)



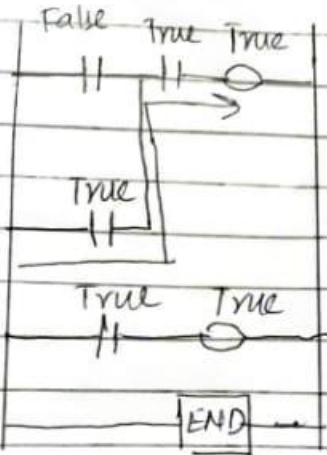
Initially the tank is empty
Therefore, input 0000 is true
and input 0001 is also
true.

Scan (2)



The internal relay is turned
on as the water level rise.

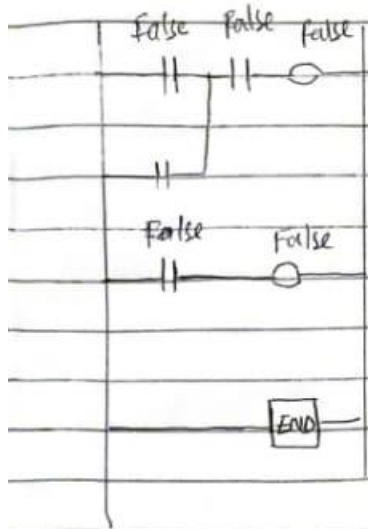
Scan (3)



After Scan 2 the al level
rises above the low level
sensor and it became open
(i.e) False.

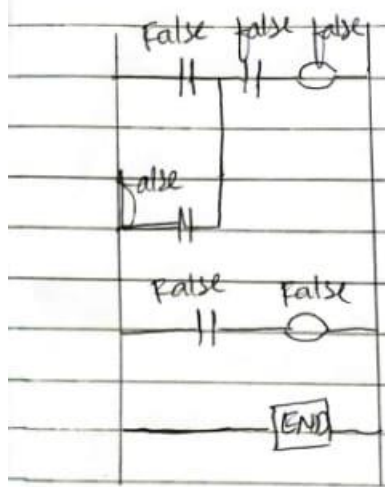
3

Scan 4



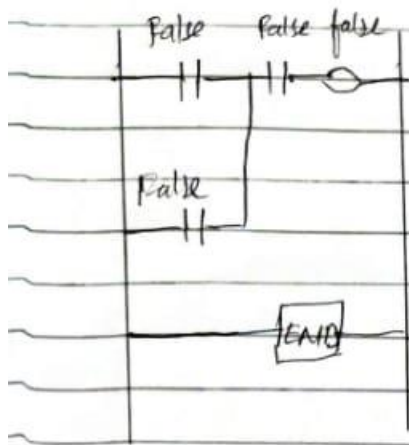
After Scan 4 the oil level rises above the high level sensors at H also become (i.e false).

Scan 5



Since there is no more true logic path output 500 is no longer energized (true) & therefore the motor turn off.

Scan 6



After Scan '6' the level falls below the high level sensor and it will become true again.

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ID 13223

Q#2(A)

Benefits of Industrial Automation:-

- Increasing productivity:
increase productivity = more units/hrs
= more money.
- Products produced more consistently:
- increase consistency = higher quality = increased consumer satisfaction

Example:-

A bottled soft drink such as Coke or a Pepsi always tastes the same no matter where or when you purchase it. Consumers count on this

- Products produced more reliably.
- robots can run 24 hours/day without getting tired or bored.
- Decreased labor expenses:
- automatic system reduces the amount of people needed to produce the goods

- Increasing Safety in working condition.

Automation system increases the safety of working condition because in this system the people should not always contact with the heavy/light machinery.

- Automation reduce cost:

Employing robots is cheaper than employing human workers. After the initial cost of factory robot the only costs are energy, maintenance and repairs. This results in big saving when compared to annual salaries for human workers and higher return on investments.

- Automation makes manufacturing better

Industrial automation not only makes manufacturing more profitable and more efficient, it also optimizes the entire process. Machinery frees human to find new process, improve technologies and focus on the work that can't be automated. This leads to new innovative products, increased customization and a better consumer experience.

Q#2(B)

Components of SCADA:

① Human machine interface:

It is an I/O device that allows a human operator to control the process data. This is achieved by linking SCADA's data base and software programs for providing management information like detailed Schematics, scheduled maintenance, data diagnostic and logistic information. The operating personnel can also see the graphical representation of data.

• Supervisory System:

This system act as a communication serve between the HMI software in control room workstation and its equipment like, PLC, RTUs, Sensors and data Acquisition. Smaller Supervisory Control and data Acquisition have only the single Pc that serve as a Supervisory or master system. Larger Supervisory Control and data Acquisition System have multiple servers, sites for disaster recovery and distributed software applications.

• Remote Terminal bus:

The system contain physical objects that are interfaced with remote terminal units. These electronic devices are controlled by microprocessor and are used for transmitting recorded data for the supervisory system. They also receive data from the master system in order to control the connected objects.

• Programmable Logic Controllers:

PLC's find their use in Supervisory Control and data acquisition system through sensors. They are attached to the sensors in order to convert the sensor output signal in to digital data.

They are preferred over RTUs because of their configuration, flexibility, affordability and versatility.

o Communication Infrastructure

Generally combination of direct wired connection and radio is used in Supervisory Control and Data Acquisition System. However, SDH/SONET can also be used for larger systems like railways and power stations.

o SCADA programming

SCADA programming in HMI or master station is used for creating diagrams and maps that provide visual information during process of event failure. Most of the Commercial Supervisory Control and Data Acquisition System used standardized interfaces in programming.

Functions of SCADA systems:-

DATA Acquisition:-

First a system you need to monitor are much more complex than just one machine with one input output.

So a real life SCADA system needs to monitor hundred or thousands of sensors.

Some sensors measure input in the system (for example, water flowing in to a reservoir) and some sensors measure

output (like valve pressure as water is released from the reservoir). Some of

these sensors measure simple events that can be detected by straight forward on/off switch called a discrete input (or digital output).

For example: in our simple model of the widget fabricator, the switch that turn on the light would be discrete

input. In real life discrete input are used to measure simple states, like whether equipment is on or off, a tripwire alarm,

like a power failure at a critical facility. Some sensor measure more

complex situation where exact measurement is important.

Data Communication:-

In our simple model of the widget fabricator the "network" is just the wire leading from the switch to the panel

light. In real life you want to be able to monitor multiple systems from central location, so you need a communication network to transport all the data collected from your sensors.

The Remote Telemetry Unit (RTU) is needed to provide an interface between the sensor and SCADA network. The RTU encodes sensor input into protocol format and forward them to the SCADA master in turn the RTU receive control commands in protocol format from the master and transmit electrical signal to the appropriate control relays.

Data Presentation:-

The only display element in our model SCADA system is the light that comes when the switch is activated. The obviously won't do on a large scale. You can't track a lightboard of the thousand separate light, and you don't want to pay someone simply to watch a lightboard.

The master presents a comprehensive view of the entire managed system and present more detail in response to user request. The master also perform data processing on information gathered from sensors. It maintain report logs and summarizes historical trends.

Control?

Our ~~was~~ miniature SCADA system monitoring the widget fabricator doesn't include any control elements. Let's say the human operator also has a button on his control panel. When he presses the button, it activates a switch on the widget fabricator that brings more widget parts into the fabricator.

For example:

if too much pressure is building up in a gas pipeline the SCADA system can automatically open a release valve. Electricity production can be adjusted to meet the demands on the power grid.

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Q # 3 (A)

Hardwired control System

PLC System

- The functions are determined by physical wiring

- The functions are determined by a program stored in memory.

- Changing the function means changing the wire

- The control function can be changed simply by changing the program

- Can be contact-making type (relays, contactors) or electronic type (logic circuit).

- Consist of control device to which all the sensors & actuators are connected.

Q 13

Q # (3) B

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