



**SCHOOL OF ELECTRICAL & ELECTRONIC
ENGINEERING**

**DIPLOMA IN ELECTRICAL/ELECTRONICS ENGINEERING
(RENEWABLE ENERGY)
STAGE 4/5**

EED550 –Programmable Logic Controller

SEMESTER 1 - 2019. Total [100marks]

DURATION: 3 HOURS 10 MINUTES

DAY/DATE: As per TT TIME: As per TT ROOM: As per TT

INSTRUCTIONS TO STUDENTS

1. *You are allowed 10 minutes Extra reading time during which you are NOT to write.*
2. *Begin each answer on a fresh page and use both sides of the sheet.*
3. *Write your candidate-number at the top of each attached sheet.*
4. *Insert all written sheets in their correct sequence and secure with string.*
5. *For all sheets of paper on which rough/draft work has been done, cross it though and you MUST ATTACH to your answer scripts.*
6. *Write clearly the number(s) of the question(s) attempted on the top of each sheet.*
7. **ANSWER ALL QUESTIONS.**
8. *Show all workings where necessary.*
9. *Do not use programmable calculators, especially the ones that does the conversions of number systems.*
10. ***ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM!***

SECTION A: **Instruction:** Answer all questions.

Total (20 marks)

Question 1

Develop the ladder logic that will turn on a light, after switch A has been closed 5 times. Push button B will reset the counters.

(5marks)

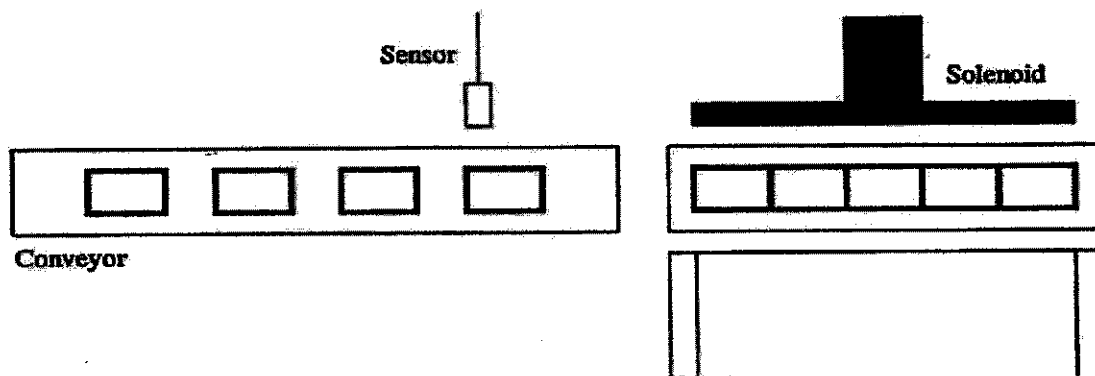
Question 2

Apply a PLC program that will run the motor in forward direction when the forward push button is pressed. Also include when the reverse push button is pressed the conveyor runs in reverse direction. Lastly, interlock the auxiliary contacts to prevent the motor from being energized simultaneously.

(5marks)

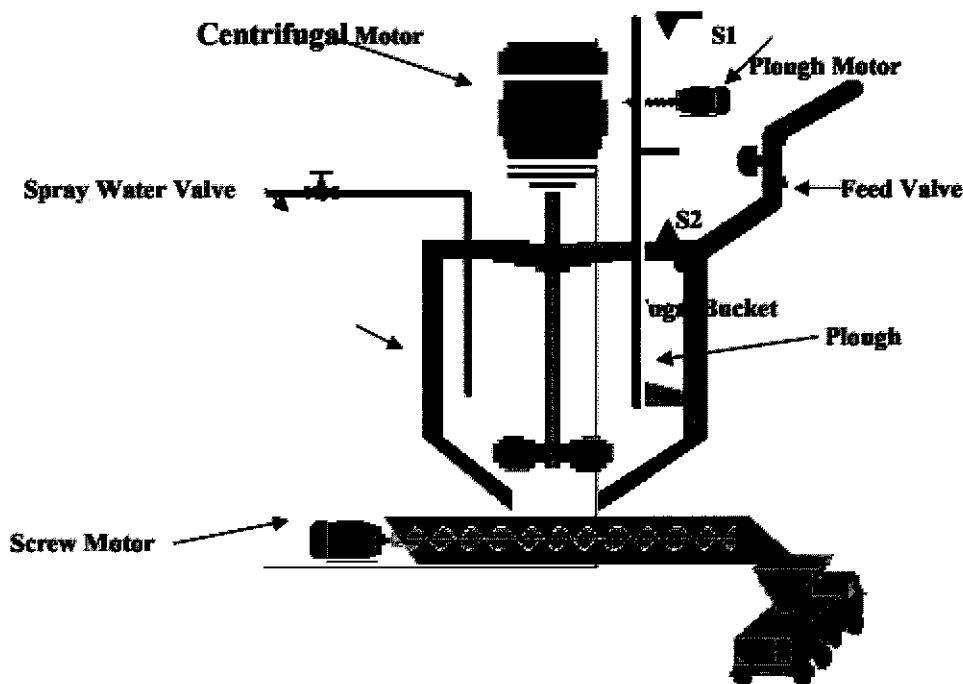
Question 3

Apply a PLC program to control a circuit is used to detect and count the number of products being carried on an assembly line. When it counts five products, the circuit energizes a solenoid. The solenoid is energized for a period of two seconds and then shuts off, causing it to retract.



(10marks)

Question 1



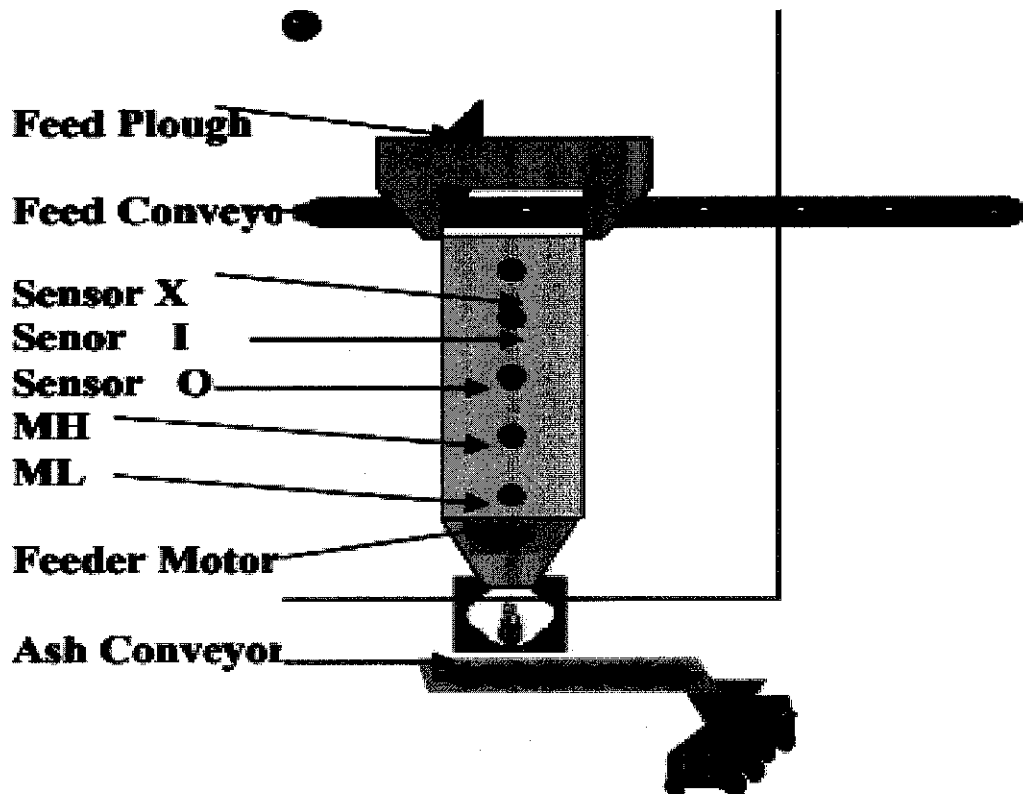
Automatic Centrifugal Control

Design ladder logic for a fugal operation that deploys the following conditions. When on automatic the screw starts first. The fugal motor starts running, 5 secs after the fugal motor has started the spray water valve opens 10 secs for rinsing and closes again. As soon as the spray water valve has closed the feed valve opens for 15 secs and takes feed. The fugal motor spins for 20secs after this and stops. The braking cylinder applies brake to the fugal bucket for 3 secs and then allows it to rotate freely at a lower speed. After the brake has de-energized, the plough motor starts running until the plough hits the low limit switch. Hereafter the motor reverses and pulls the plough up until the top limit switch is activated. The whole cycle begins again and continues.

(15marks)

Question 2

Chute Height Control



Consider the above chute height and feeder control for a boiler. The chute height is controlled by the High and Low sensor switches. If the feed is below the Low sensor O solenoid is energized to open the Feed Plough. It continues to take feed until the High level sensor I is reached. It then waits for the feed to fall below low level and repeats the cycle. If the sensor X is reached the conveyor should stop. Remember nothing should be operational if the conveyor is stopped. Operation should only continue once the conveyor starts again.

Senor MH and ML control the feeder motor. If the feed goes below ML the motor must stop and only come ON when the high level has been reached. Include an overload for the feeder motor that will also trip the conveyor

Also include a delay (3 secs) on each sensor input to avoid momentary activation of the inputs to the PLC.

(15marks)

SECTION C

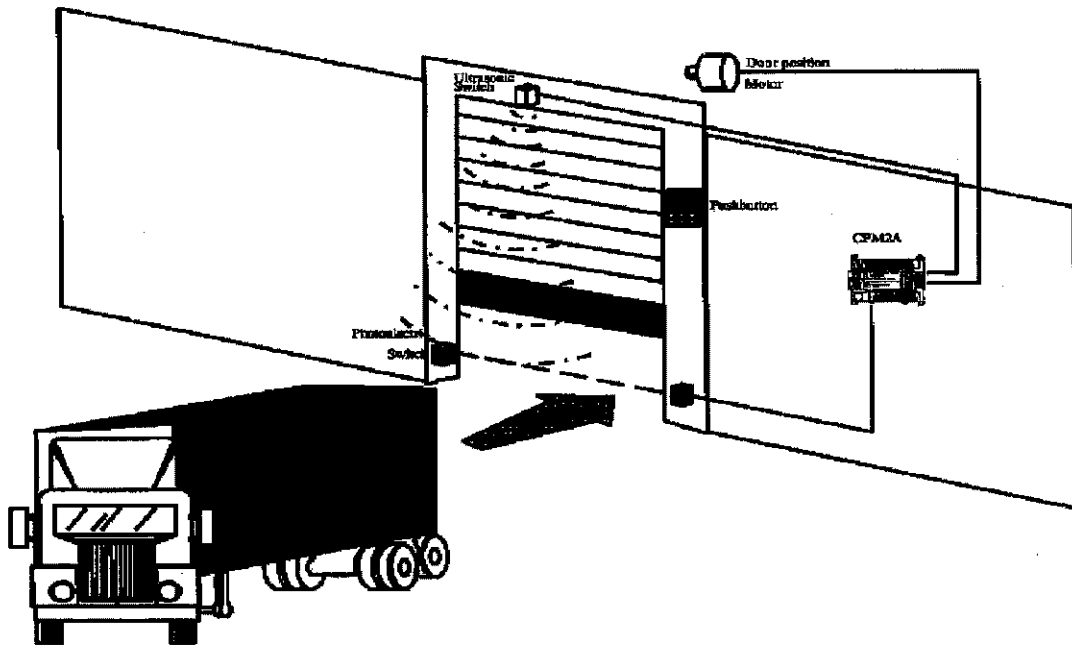
Instruction: Answer all questions

Total (50 marks)

Question 1

Automatic Control of Warehouse Door

Apply a PLC program to control the warehouse door. The input Ultrasonic switch is employed to detect the presence of an approaching vehicle. A separate photosensor detects the passing of a vehicle via the interruption of the light beam. In response to this signal, the control circuits controls the output that drive the motor of the door for opening and closing..



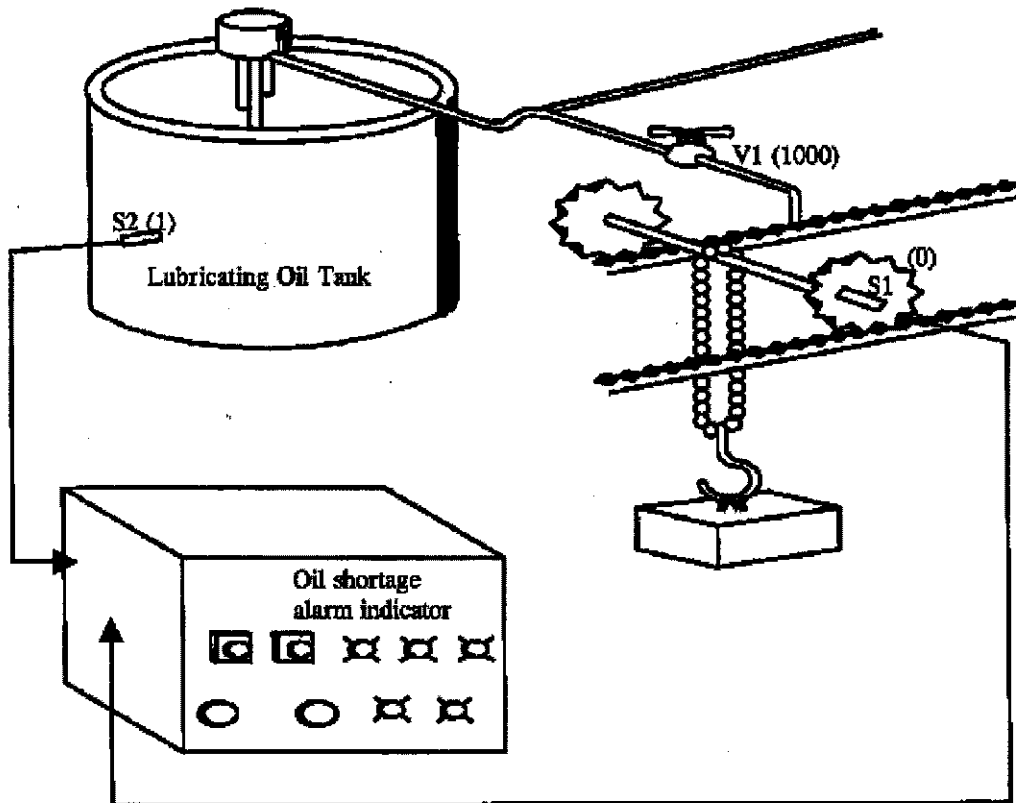
Inputs	Device	Output	Device
0.00	Ultrasonic Switch	100.03	Motor Opening
0.01	Photoelectric Switch	100.05	Motor Closing
0.03	Door Upper limit Switch		
0.04	Door Lower limit Switch		

(15marks)

Question 2

Automatic Lubrication of Gear

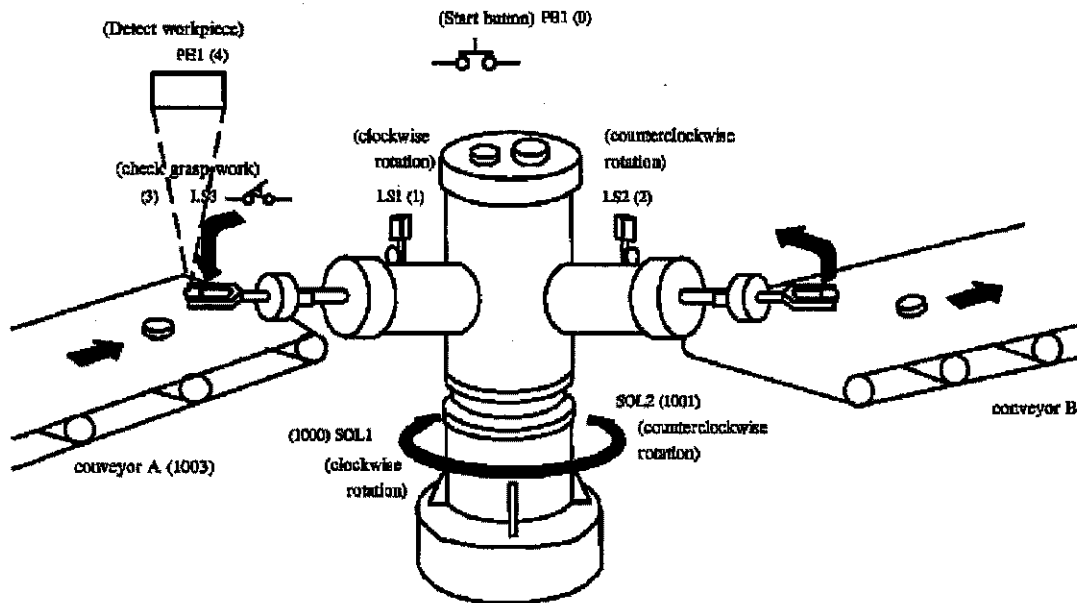
Apply a PLC program when the gear is moved towards S1, the sensor S1 will detect the gear and signal the electromagnetic valve for oil supply on the gear. The valve (V1) will open for a short period of time supplying a predetermined quantity of oil. When sensor S2 sense that the lubricating tank oil level is low, the oil shortage alarm indicator will be ON.



Inputs	Device	Inputs	Device
0.03	Position detection S1	100.02	Electromagnetic valve for oil supply
0.05	Lower limit of oil S2	100.03	Oil shortage alarm indicator

(15marks)

Question 3



This kind of robot is seen in many automated factories and this robot picks up a work being carried on conveyor A and places it on conveyor B.

Looking at the above figure closely will disclose that the robot performs one operation at a time when a given condition is met. Let's analyze these operation and condition.

- When a start button is pressed, the robots rotate its arm clockwise.
- When the robot arm has moved to the position of the work in conveyor A, the arm grasps the work piece.
- When the arm has grasped the work piece, it rotates counterclockwise.
- When the arm has rotated to the position of conveyor B, it releases the work piece.

(20marks)

THE END