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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

FIFTH SEMESTER B.TECH. (ELECTRONICS & INSTRUMENTATION ENGG.)

END SEMESTER DEGREE EXAMINATIONS, JANUARY - 2021

Industrial Automation [ICE 4302] (OPEN ELECTIVE)

06-02-2021

TIME: 3 HOURS MAX. MARKS: 50

Instructions to candidates :*Answer ALL questions and missing data may be suitably assumed.*

1A. Write a ladder logic and timing diagram for the process shown in Fig1.A.

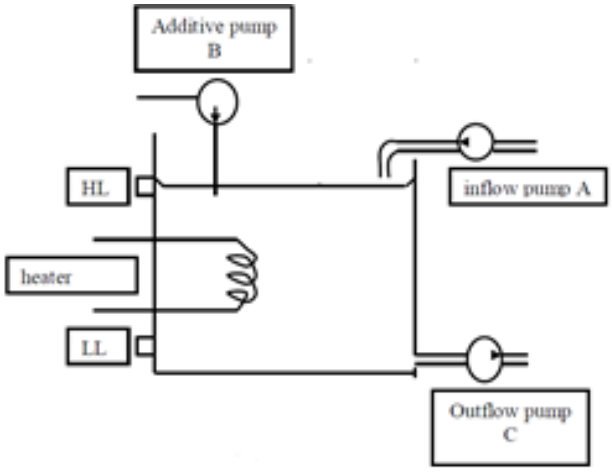

Fig: 1A

The problem statement is as follows:

Step 1: Filling the liquid in a tank

The tank is filled with liquid from pump A until the high level switch is reached, then a small amount of liquid is added by running additive pump B for 10 seconds. The mixture is heated to 60ºC before being drawn off (step 2) as required. Pump C is used to drawn off the mixture from the tank.

Step 2: Draining the liquid from tank

While draining the tank, all the actuators like pump A, pump B and heater should be off and pump C should be on until level reaches to low level. When the level of tank reaches to low level then control of program need to go to step 1. This cycle repeats continuously.

Use a start button to start the process and stop Button to stop the process. Strictly follow the sequence as mentioned in the Problem statement.

1B. With neat diagrams, explain different types of redundant techniques for DCS and mention their advantages and applications.

(5+5)

2A Explain the following instructions

i) ACS ii) SQR iii) LIM iv) ASN v) XPY

2B Design a ladder diagram for implementing a 4:1 multiplexer and 1:4 demultiplexer

2C With help of a flowchart explains different stages involved in PLC scan cycle.

(3+4+3)

3A A conveyor is running by switching on or off a motor. We are positioning parts on the conveyor with an optical detector. When the optical sensor goes on, we want to wait 1.5 seconds, and then stop the conveyor. After a delay of 2 seconds, the conveyor will start again. We need to use a start and stop button - a light should be on when the system is active. Gages have been attached that indicate good or bad. If the part is good, it continues. If the part is bad, we do not want to delay for 2 seconds, but instead actuate a pneumatic cylinder.

3B Draw the ladder logic and digital logic for the following expression

$$(A+B+C+D+E)^3.$$

Note1: Do not use X power Y Instruction.

Note2: For digital logic use AND/ OR gates only.

(5+5)

4A Consider a decorative system with an LED flashing ON and OFF for 4 and 6 sec respectively. If the start button is triggered more than five times there should be a circuit breaker to interrupt the process for next 3 min. [Note: use a timer without reset]

4B Write ladder logic to control a motor with two switches: GO and STOP. The GO switch is used to start the motor and the STOP switch is used to stop it. If the motor is on and the GO switch is pushed, the motor should stop. If the STOP switch used to stop the motor, the GO switch must be pushed thrice to start the motor. When the motor is running, a light should be turned on.

4C Describe the need of PLCs in process control industries with a suitable example.

(3+4+3)

5A Illustrate with an example different modes of operation in HART Protocol.

5B In a printing press industry, a hydraulic machine has three inputs, which has to be activated within a time interval of 5 sec to start the process. If the process is stopped, using a stop switch then the cooling fan has to run for 4 min more to dissipate heat generated in the process. Write appropriate ladder logic diagram to satisfy the process requirement. [Note : use latching technique to activate the process]

5C Draw suitable ladder logic diagram to meet the following process requirement. A sheet metal manufacturing industry has a conveyer belt running across the production unit. The length of the sheet metal placed on the conveyor belt monitored using proximity sensor with a tolerance of ± 1 cm each side. If there is a difference in length, the process needs to be interrupted with a delay of 2 mins until the sheet rejected. If the number of rejections is more than 30, the process needs to be restarted with a delay of 20 mins. [note – the set point for sheet length is 49 cm]

(4+3+3)

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