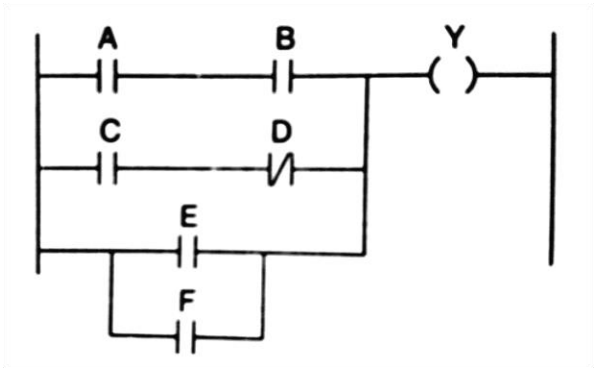
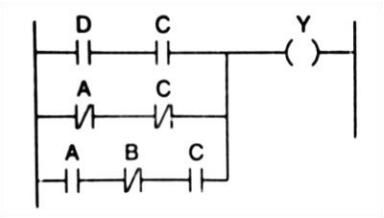
Name: **Enrolment No:**	UPES

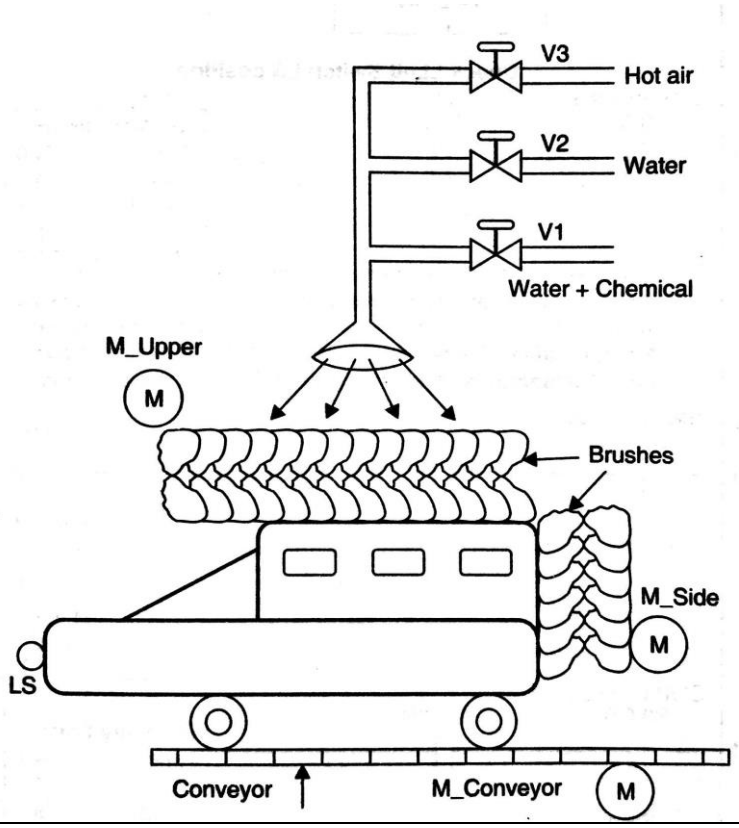
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: SCADA and Automation **Semester: III**
Programme: B. Tech Instrumentation and Control Engineering
Time: 03 hrs. **Max. Marks: 100**
Instructions: All questions are compulsory.
Assume, if data is unavailable.

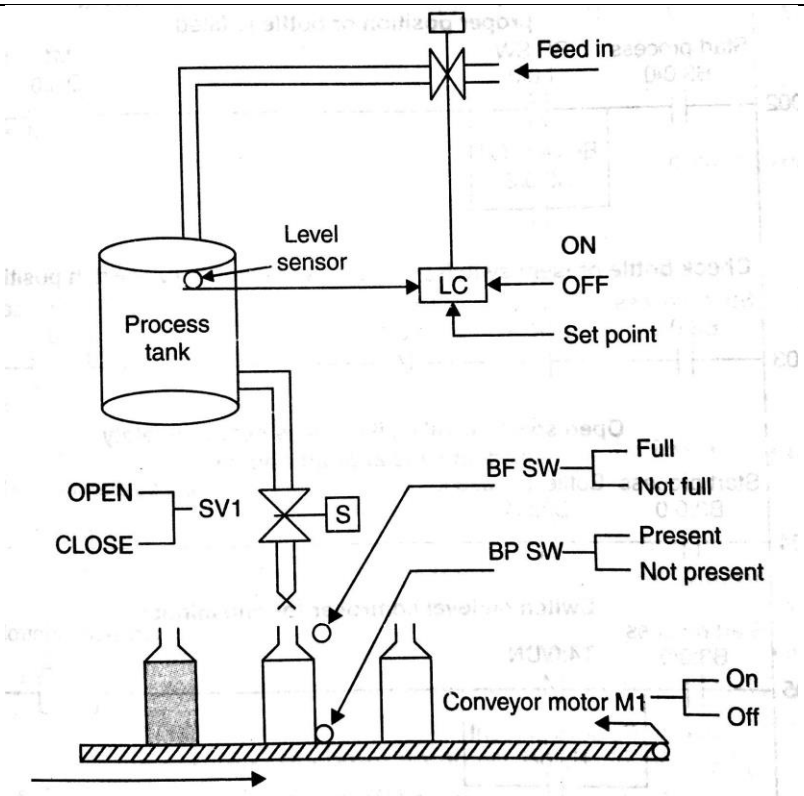
SECTION A

S. No.		**Marks**	**CO**
Q 1	Fill in the blanks: i. ……is the benefit of SCADA a. Improved facility effectiveness b. Small in size c. Modularity d. Easy programming ii. …… gathers information from field devices. a. RTU b. MTU c. Input conditioner d. Communication interface iii. In …… message, it is generated when a tag value goes into alarm a. System b. Alarm c. SCADA d. Acknowledgement iv. ……is a visual representation of real time or historical tag values, provides to track plant activities a. Alarm b. Trend c. Graphic Display d. Log	**4**	**CO1,5**
Q 2	Convert the following ladder diagram shown below into digital gate circuit: i.	**4**	**CO1**

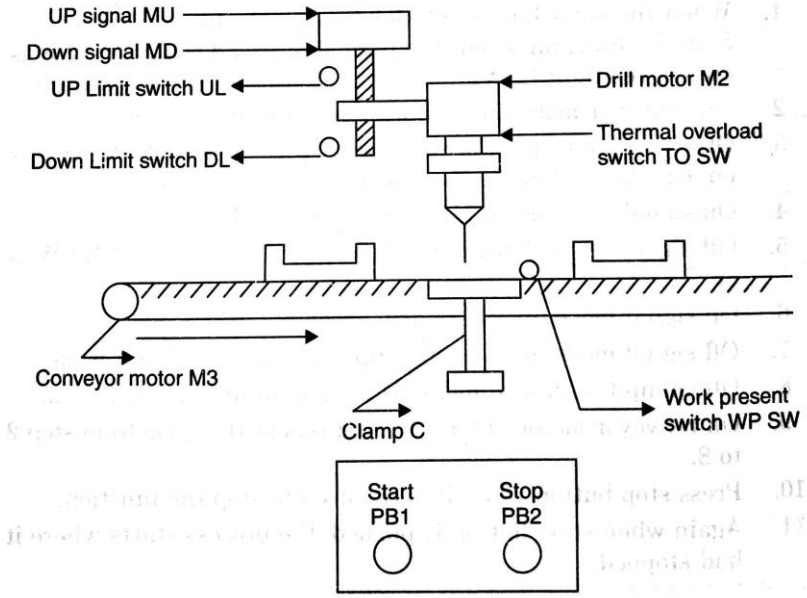
	 ii. 		
Q 3	True or False: i. An example of discrete control is: a. Varying the volume of a music system b. Turning a lamp ON or OFF c. Varying the brightness of a lamp d. Controlling the speed of a fan ii. A solenoid is an example of an output device. a. True b. False c. None of the above iii. To increase the number of inputs and outputs of the PLC, one can use expansion modules. a. True b. False c. None of the above iv. Which one of the following is not a PLC manufacturer? a. Siemens b. Mitsubishi c. Microsoft	**4**	**CO1,2**

	d. ABB		
Q 4	Elucidate the selection criteria of PLC.	**4**	**CO1,2**
Q 5	What is optocoupler and why it's been used in PLC's.	**4**	**CO1**
	SECTION B		
Q 6	The system shown below in the figure employs washing a car in a washing chamber. It includes: i. Detecting a car in a washing chamber. ii. Washing a car by spraying chemical and water. iii. Brushing (only upper and right side of car) iv. Drying a car using hot air v. START push button is used to start the process. STOP is used to stop the process. LS limit switch is used to detect a car in washing chamber. M_CONVEYOR is used to drive the conveyor until the car is in a position, as indicated by car present switch LS. V1 valve is used to sprinkle water + Chemical on a car. V2 valve is used to sprinkle water on a car. V3 valve is used to spray hot air on a car M_UPPER motor is used to move the brush on the upper side of a car. M_RIGHT motor is used to move the brush on the right side of a car.  	**10**	**CO3,4**

	Prepare a ladder logic to implement the following continuous process. Logic: i. When START push button is pushed, the function starts. ii. On M_CONVEYOR motor, when LS- limit switch is off. iii. Off M_CONVEYOR motor, when LS- limit switch is on. iv. On V1 valve, omn M_UPPER, on M_SIDE for 100 seconds when LS- limit switch is on. v. Off V1 valve, after 100 seconds. vi. On V2 valve, when valve V1 is off. vii. Off V2 valve, after 50 seconds. viii. On V3 valve, when valve V2 is off. ix. Off V3 valve, after 50 seconds. x. On M_CONVEYOR motor again		
Q 7	In reference to previous question no. , repeat the cycle from step ii to ix, when you reach in step x. x. On M_CONVEYOR motor again and repeat the cycle from step ii to ix.	**10**	**CO3,4**
Q 8	What are the cyber threats on SCADA systems and what are the probable precautions against them.	**10**	**CO5**
Q 9	Discuss significant features of SCADA system, citing example.	**10**	**CO5**
	SECTION-C		
Q 10	The composite discrete/ continuous control system shown below in the figure employs, maintaining the level of the tank at the set point, when the outlet valve is open and bottle is filling with liquid. However that periodically bottle comes into position under the outlet valve. Bottle present switch BP SW (sensor) is used to detect the bottle present condition. Bottle full switch (sensor) BF SW (sensor) is used to detect the bottle full condition. Start push button START is used to start the process. Stop push button STOP is used to stop or to reset the process. Conveyor motor M1 is used to drive conveyor until the bottle is in position as indicated by bottle present switch opening. The outlet valve SV1 is used to fill the bottle with liquid. The level control system LC is used to maintain the level of the tank at the set point, by controlling the input control valve.	**20**	**CO3,4**

	 Prepare a ladder logic to implement the following continuous process. Logic: i. When start button START is pushed, the process starts. ii. On level control system LC for 1 minute. iii. Off level control system LC after 1 minute. iv. On motor conveyor M1, when bottle present switch BP SW is off. v. Off motor conveyor M1, when bottle present switch BP SW is on. vi. On solenoid valve SV1 and level control system LC, if bottle full switch BF SW is off. vii. Off solenoid valve SV1 and level control system LC, when bottle full switch BF SW is on. viii. On motor M1 again, when bottle full switch BF SW is on. Keep this motor conveyor M1 is on, till bottle present switch BP SW is off. And bottle is moved out of position. ix. Repeat the steps iv to viii for continuous control. x. Press stop button STOP when it is required to reset the process. xi. Again when start button is pushed, the process starts, where it had stopped.		
Q 11	The system shown in figure employs drilling a hole in an object, moved on a conveyor belt. Start button START is used to start the function. Stop button STOP is used to stop the function. Up limit switch UL SW is used to detect up position of drill M2. Down limit switch DL SW is used to detect down position of drill M2. Thermal overload switch TO SW is used to detect high temperature condition for drill M2.	**20**	**CO4,5**

Sensor, work present WP SW is used to detect the work or object under the drill position.
Conveyor motor M3 is used to move an object on conveyor belt.
Clamp C is used to clamp an object.
Drill motor M2 is used to drill a hole in an object.
Red light R is used to indicate high temperature.
Signal MU is used to move drill assembly up. Signal MD is used to move drill assembly down.



Prepare a ladder logic to implement the following continuous process.

Logic:

i. When the start button START is pushed, the function starts. Stop the function when the thermal overload switch TO SW is on. On red light R as an alarm to indicate high temperature.
ii. On conveyor motor M3 if work present switch WP SW is off.
iii. Off conveyor motor M3 if work present switch WP SW is on. On clamp C to clamp an object. On drill motor M2.
iv. On signal move down MD to move assembly down.
v. Off signal move down MD when down limit switch DL SW is on.
vi. On signal move up MU to drill assembly up.
vii. Off signal move up MU when up limit switch UL SW is on.
viii. Off clamp C and drill motor M2 when up limit switch is on.
ix. On conveyor motor M3 again and repeat the cycle from step ii to viii.
x. Press stop button when it is required to stop the function.
xi. Again when start button is pushed, the process starts where it had stopped.

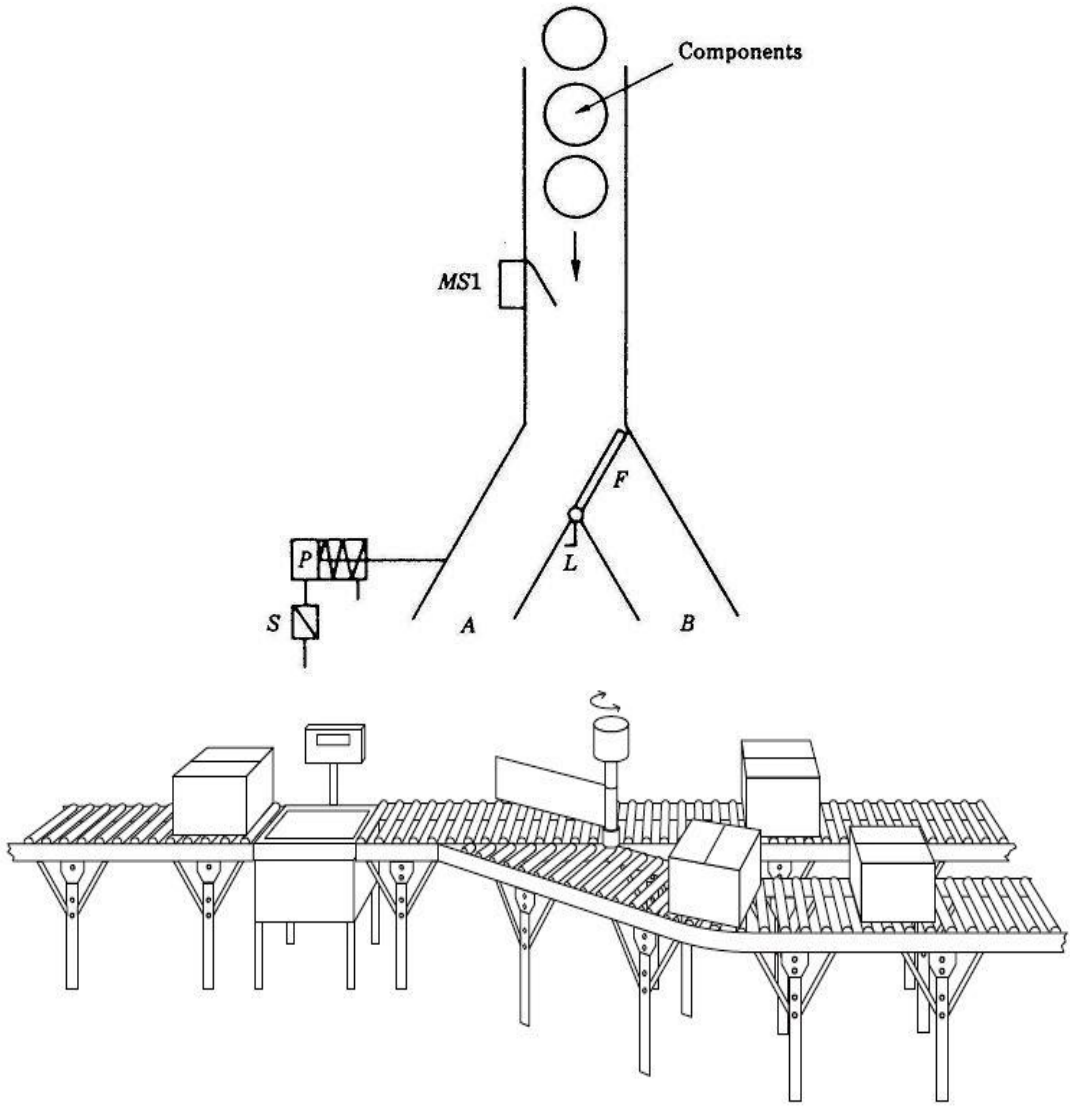
Name: **Enrolment No:**	UPES

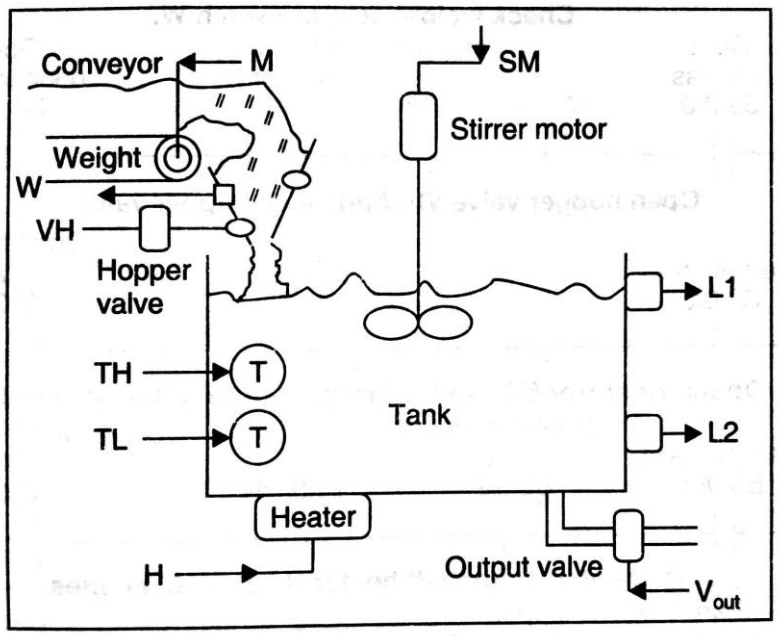
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: SCADA and Automation **Semester: III**
Programme: B. Tech Instrumentation and Control Engineering
Time: 03 hrs. **Max. Marks: 100**
Instructions: All questions are compulsory.
Assume, if data is unavailable.

SECTION A

S. No.		Marks	CO
Q 1	Fill in the blanks: i. For off delay timer, when transition low signal is applied to timer, the enable bit (IN in Bosch Rexroth L20 DP) status is ……. a. Low b. High c. High or low d. Low and high ii. …….instruction output is logic high, if instruction is true. a. Counter b. Comparison c. Maths d. Sequencer iii. One-shot instruction produces …….output. a. Low b. High c. Serial d. Pulse iv. …… shows the connection of input and output devices to PLC a. Block diagram b. Wiring diagram c. Flow diagram d. System diagram	**4**	**CO2,5**
Q 2	The process heater (H) will be turned on when the following conditions are met i. Input A must be on. ii. Both inputs B and C must be off. iii. One or more inputs D, E and F must be off. Draw the digital gate diagram and ladder diagram for it.	**4**	**CO1,2**
Q 3	Usually for Industrial environment, PLC's are preffered over microcontrollers, why?	**4**	**CO1**
Q 4	Explain what is SCAN in PLC.	**4**	**CO1,2**
Q 5	Why 4-20 mA type signal is preferred (in case of sensors) in PLC for industrial automation purpose?	**4**	**CO1**

SECTION B			
Q 6	Discuss the architecture of SCADA system, citing example.	**10**	**CO5**
Q 7	Explain in brief various reasons of failure of SCADA system	**10**	**CO5**
Q 8	Prepare a toggle switch using push button only in ladder logic.	**10**	**CO2,3**
Q 9	We are using a Batch Machine, which is been controlled by PLC. It counts and batches components moving along a conveyor. It is required that ten components be channeled down route A and twenty components down route B. A reset facility is required for emergency stop purpose. Write a ladder logic program to do so. 	**10**	**CO4**
SECTION-C			

Q 10	The process shown below in the figure shows a system for batch processing. The system operation can be described as follows: i. A weight quantity of dry material is added to liquid that will fill the tank to level L1. ii. The mixture is stirred and heat is applied to maintain the temp between TL and TH for a period of 10 minutes. iii. With the stir and heater off the batch is emptied down to level L2. The whole process then start again. Vout valve is used to drain the liquid. High level switch L1 and Low level switch L2 are used to detect high level and low level of liquid in the tank, Start push button START is used to start the process. Stop push button STOP is used to stop or reset the process. Motor rotates the stirrer, is used to mix the liquid. Heater is used to maintain the temp of the liquid between the TL and TH. Conveyor motor is used to pour the weighted dry material in the Hopper. Hopper valve Vh is used to add the weighted dry material into the tank. Weight sensor W is used to sense the set point weight of dry material. TH and TL are used to detect the high and low temperature respectively.  Prepare a ladder logic to implement the following continuous process. Logic: i. When the start button is pushed, input valve V1 opens, allowing water to come in the tank. ii. In case water goes above high level L1, the input valve closes. iii. The motor conveyor turns on allowing weighted quantity of dry material to pour into the hopper. When the weight sensor is on, the conveyor motor turns off.	**20**	**CO3,4**

	iv. The hopper valve turns open allowing the weighted dry material to add to the liquid. v. The stirrer motor and heater turns on to stirr the liquid. The heater turns on to maintain the temperature between TL and TH for a period of 10 minutes. Both motor, stirrer and heater turns off. vi. The output valve Vout turns on, to empty the mixture down to level L2 (LOW). When the mixture level goes below the low level L2 output valve Vout closes. vii. Close Hopper valve, once the Hopper valve closes press Reset/Stop PB, and press Start PB to start the process again.		
Q 11	Create a ladder logic program that will start when input *A* is turned on and calculate the series below. The value of *n* will start at 0 and with each scan of the ladder logic n will increase by 2 until *n=20*. While the sequence is being incremented, any change in *A* will be ignored. $x = 2(log(n) - 1)$	**20**	**CO3,4**