

Name:  
Enrolment No:



**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**End Semester Examination, December 2019**

**Course: PLC, SCADA AND AUTOMATION**  
**Program: B.TECH -IOT**  
**Course Code: ICEG 423**

**Semester: VII**  
**Time 03 hrs.**  
**Max. Marks: 100**

**Instructions: Consider necessary assumptions if required.**

**SECTION A [ 5 Questions of 4 marks each ]**

S. No.		Marks	CO																				
Q1	Write the steps which will establish communication between the PC and the PLC	4	CO1																				
Q2	Discuss the difference between wiring a sourcing and sinking output?	4	CO2																				
Q3	<table border="1"> <thead> <tr> <th>Sno</th> <th>Error Message</th> <th>Reason</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>"Address expected after 'AT'"</td> <td></td> </tr> <tr> <td>2</td> <td>"Only 'VAR' and 'VAR_GLOBAL' can be located to addresses"</td> <td></td> </tr> <tr> <td>3</td> <td>"Only 'BOOL' variables allowed on bit addresses"</td> <td></td> </tr> <tr> <td>4</td> <td>"Invalid address: '&lt;address&gt;'"</td> <td></td> </tr> </tbody> </table>	Sno	Error Message	Reason	1	"Address expected after 'AT'"		2	"Only 'VAR' and 'VAR_GLOBAL' can be located to addresses"		3	"Only 'BOOL' variables allowed on bit addresses"		4	"Invalid address: '<address>'"		4	CO2					
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Q4	<p>Design ladder logic for the timing diagram below. When an input A becomes active the sequence should start.</p>	4	CO3																				
Q5	<p>The equipment-specific signals are those that connect to a unique device, such as a motor, pump or conveyor. In the water and wastewater industries, consider the field signals associated with a single pump, organized by the four basic signal types:</p> <table border="1"> <thead> <tr> <th>Sno</th> <th>Description</th> <th>Data Type</th> <th>Discrete / Analog Inputs</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Pump VFD Speed Control</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>Discharge Valve Close Status</td> <td></td> <td></td> </tr> <tr> <td>3</td> <td>Pump VFD Speed Feedback</td> <td></td> <td></td> </tr> <tr> <td>4</td> <td>Pump Run Control</td> <td></td> <td></td> </tr> </tbody> </table>	Sno	Description	Data Type	Discrete / Analog Inputs	1	Pump VFD Speed Control			2	Discharge Valve Close Status			3	Pump VFD Speed Feedback			4	Pump Run Control			4	CO1
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**SECTION B [ 4 Questions of 10 marks each ]**

Q 6	Sensors allow a PLC to detect the state of a process. Logical sensors can only detect a state that is either true or false. Explain how the three wire and four wire sensors can be integrated on the PLC Input cards with the help of example	10	CO2
Q7	1) A conveyor is run 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	10	CO3

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.

**[OR]**

2) A motor will be controlled by two switches. The Go switch will start the motor and the Stop switch will stop it. If the Stop switch was used to stop the motor, the Go switch must be thrown twice to start the motor. When the motor is active a light should be turned on. The Stop switch will be wired as normally closed

Q8 Explain the needs and requirements of the operator in the process automation control room, to meet the functional objectives. 10 CO4

Q9 Explain the RTU components to accomplish the tasks of monitoring and controlling the field devices. 10 CO4

**SECTION-C [Internal choice between Q11 and Q12]**

Q 10 a) Explain Typical SCADA System Architecture along with block diagram.  
b) State the advantages and disadvantages of SCADA system 20 CO4

Q11 **STAR/DELTA LOGIC**

- 1) By pressing the start push button, main contactor and star contactor are switched on simultaneously.
- 2) After the release of start push button, NO contact across the start P.B. acts as a hold on (latching) contact and maintains the flow of current.
- 3) As there is a On Delay Timer in series with the delta contactor, it gets switched on after the time delay specified.
- 4) So after the preset time the delta contactor is switched on and star contactor is switched off as the NC contact of delta cont. becomes NO.
- 5) Finally, the motor is operated through main and delta contactor.
- 6) Stop push button/EMERGENCY . Stop push button is used to switch off the motor or stop the entire operation.

**Typical circuit diagram of Star Delta starter**

Explain the following :

- a) Operating Sequence:
- b) Defining the Variables:

20 CO3

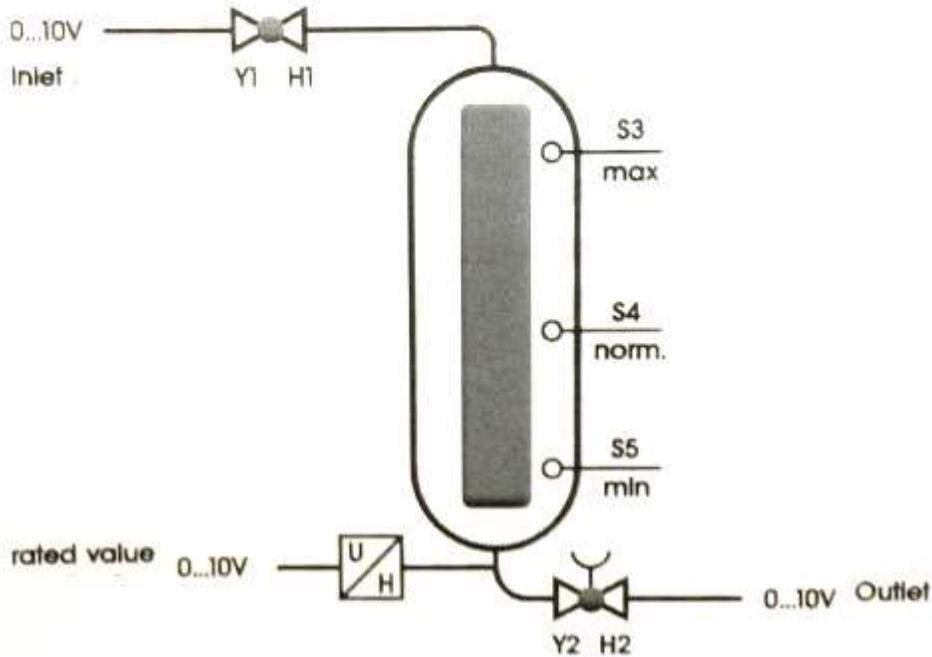
Sno	Description	Address	Symbol Name	Data Type	Location
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- d) Draw the process flowchart
- e) PLC Logic

Q12

**Level Control :**

A liquid tank shall always be filled to 50%. The level may vary by +/- 10%. After activation of the S1 pushbutton "Start", the Y1 "Inlet" valve magnet is opened and the tank is filled. The Y2 "Outlet" valve magnet is opened as soon as the S5 "Level minimum" sensor notifies a level above minimum and closed again after emptying. The filling process is to be displayed at the bar display H3. The filling process is terminated and the valve magnet is closed as soon as the tank is filled to 60%. Using the R3 "Outlet" rotary knob, the tank can be emptied. If in doing so, the level in the tank is reduced to 40%, it is automatically refilled. If the S3 "Level maximum" sensor notifies a tank overflow, the system is switched off automatically. The system can be switched off at any time using the S2 pushbutton "Stop". Afterwards, the tank is automatically emptied.



Explain the following :

- a) Operating Sequence:
- b) Defining the Variables:

Sno	Description	Address	Symbol Name	Data Type	Location
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- d) Draw the process flowchart
- e) PLC Logic

CO3