



COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY

SCHOOL OF ELECTRICAL & ELECTRONIC
ENGINEERING

BACHELOR OF ENGINEERING (ELECTRICAL/RENEWABLE ENERGY)
Year 3

EEE761 –PROGRAMMABLE LOGIC CONTROL (PLC) and SCADA SYSTEM

Total [100marks] Exam Duration [3hour 10 minutes] Total # Pages 4

SEMESTER 1 - 2016.

DAY/DATE: TIME: ROOM: As per timetable.

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 (10 marks)

Question 1:

Develop the ladder logic that will turn on an output light, 10seconds after switch A has been turned on. (3marks)

Question 2:

Develop the ladder logic that will turn on a light, after switch A has been closed 3 times. Push button B will reset the counters. (3marks)

Question 3:

Explain with example how the CNTR (012) behave with real practical application. (4 marks)

SECTION B: Instruction: Answer all questions. Total (55 marks)

1. Unity Pro is able to use the five IEC standard languages name those five languages. (5marks)
2. The languages consist of three graphical and two textual programming tools. Explain each of them with illustration. (5marks)
3. Explain steps required in creating a new programming section using a chosen language. (10marks)
4. Write ladder logic for the application of a process that is filling the tank with water. You should have a start/ stop circuit to start the application and should assure that the tank does not run empty or overflow.

Table 1: List of I/O

I/O	
start	0.01
stop	0.02
Run Valve	100.01
Pump	100.02
High Level sensor	0.04
Low Level sensor	0.05
High Level indicator	100.06

Illustrate the hard wiring clearly by identify the control and power circuit. (15marks)

5. Use elementary Functions (EFs) to write the program for the calculation of tank average with the given information below. Unity Pro is supplied with over 900 in built functions. An EF is represented graphically as a box with multiple input pins and one output pin. The name of the EF (that is, the EF type), is displayed in the Centre of the box.

AND FUNCTION

The output of an AND function is TRUE when all the inputs are TRUE. That is, if any input is FALSE, the output will be FALSE. The simplest AND function has only two inputs.

OR FUNCTION

The output of an OR function is TRUE when any the inputs are TRUE. The simplest OR function has only two inputs.

Unity Pro has hundreds of Elementary Functions, for example, ABS (absolute Functions value), ADD_TIME (add two or more times), EQ (equal to), TAN (tangent in radians).

Create a Function Block Diagram to calculate the average tank level.

Name	Value	Data Type	Comment
FBD_Level1	100	INT	
FBD_Level2	200	INT	
FBD_Level3	300	INT	
FBD_Level4	400	INT	
FBD_Average	250	INT	

(20 marks)

SECTION C: Instruction: Answer all questions. Total (35 marks)

1. Write the program for creating a process start section in ladder logic. Explain how the new section and programming language is selected.

Variable Name	Data Type
Stop_Process	BOOL
Process_Started	EBOOL
Plant_Running	EBOOL

(5 marks)

2. Write the program using structured for refilling the tank. Part of the program is given below.

```
IF Refill THEN
Tank_Level := Tank_Level +10;
END_IF;
IF Empty THEN
Tank_Level := Tank_Level -10;
END_IF;
```

(10 marks)

3. Briefly explain how the new project is created in the Citect explorer SCADA. (2 marks)
4. Name at least 5 objects(electrical/mechanical components) used in building this Citect graphics Builder [Process-Line]. (3 marks)
5. The sequence of the given process needs to be controlled. The process should be started by pressing a START switch and can be stopped by pressing a STOP switch. Both start and stop switches are momentary contact type switch. The float switches are both normally opened (NO) and both the solenoid is energized to open. The sequence of the process should be as follows: First the FILL SOLENOID will open as soon as the start switched is pressed allowing fluid A to flow into the tank. As soon as the fluid level reaches 2nd (upper) float switch FILL SOLENOID must close and an AGITATOR motor will start and the agitator should run for 3 minutes. As soon as the agitator stops, EMPTY solenoid will open and empty the process fluid from the tank. The EMPTY SOLENOID remains open until the tank level comes down to 1st (lower) float switch. Once the tank is empty, the process should wait for another manual start of the process. Implement using the PLC control. Use the appropriate software to draw control and power circuit.

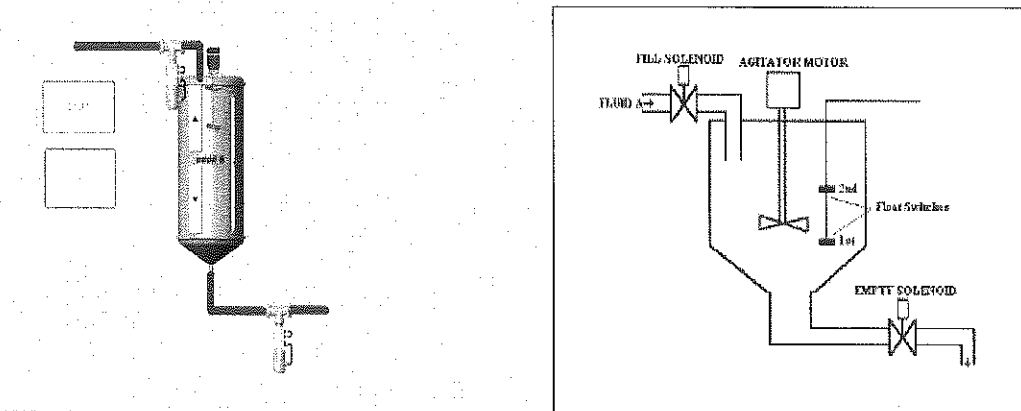


Figure: 3 SCADA control Schematic and Single Line Diagram

(15 marks)

All the Best
The End...