FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY

SCHOOL OF ELECTRICAL & ELECTRONIC ENGINEERING

TRADE DIPLOMA IN ELECTRICAL ENGINEERING
(ELECTRICAL/RENEWABLE ENERGY)
STAGE 3

EEE547 –Programmable Logic Control

Trimester 3 - 2015. Total [100marks] Duration 2hours 10 minutes

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, 15 seconds after switch A has been turned on. (5marks)

Question 2:

Develop the ladder logic that will turn on a light, after switch A has been closed 10 times. Push button B will reset the counters. (5marks)

SECTION B: **Instruction:** *Answer all questions.* **Total (40 marks)**

1. Draw a ladder rung to turn on a motor when the limit switch is activated or when the selector switch is activated. All contacts are single pole double throw. Illustrate the hard wiring clearly by identify the control and power circuit. (5marks)

2. Draw the ladder rungs that turn on a motor contactor and green pilot lamp for the following limit switch conditions: LS1 orLS2 are true and LS3 or LS4 are not true. Remember that the term true or active means a switch is activated and not true or not active means it is in the normal position. All switches are double pole double throw. Illustrate the hard wiring clearly by identify the control and power circuit. (10marks)

3. 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

I/O List	
Start	0.00
Stop	0.01
Run	100.00
Pump	100.01
High Level Sensor	0.02
Low level Sensor	0.03
High Level Indicator	100.03

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

4. Consider a simple example in a factory the parts arrive at a workstation, one by one, on a conveyor. A photo-switch is used to detect arriving parts. After 4 parts have arrived, the conveyor is stopped and a light indicator switches ON. The operator then loads the arrived parts into the machine tool and restarts the conveyor for the next batch of parts to arrive. Design the ladder program that can be used to provide the control for this problem. Sketch the hard wiring clearly by identify the control and power circuit (10marks)

SECTION C
Instruction:
Answer all questions.

Question 1

As a PLC engineer you are required to design the ladder logic for the bottle filling machine based on the specifications given. (10 marks)

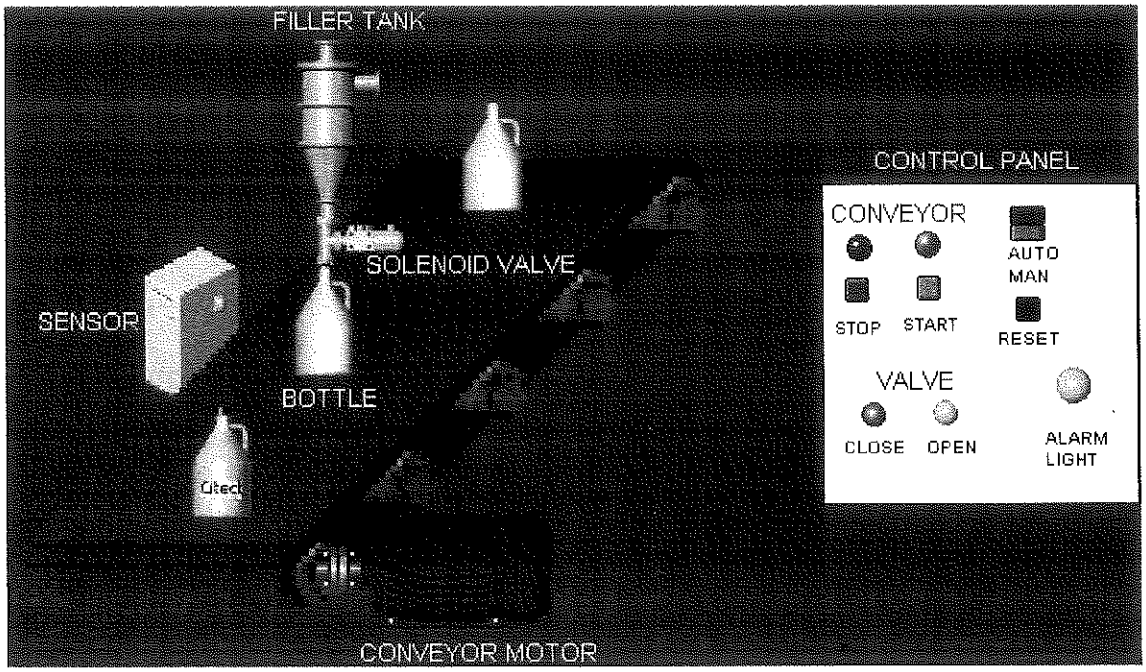

Figure 1: SCADA Control of Bottle Filling Plant

Operation
Fill the bottle for 15 seconds when the proximity turns on or sense the bottle. If the bottle stays over the proximity sensor for more than 5 seconds after filling to capacity, indicate that a fault has generated by turning on the product jammed light and stopping the conveyor for safety issues.

Table: 2

I/O		
Start	Pushbutton	0.00
stop	Pushbutton	0.01
Proximity Sensor	Sensor	0.03
Filling Valve	Actuator Valve	100.00
Product Jammed Alarm	Alarm	100.01
Conveyor Motor	Motor	100.02

Question 2

Design the ladder logic used to rinse the process tank after each process reaction with the water fill, mix and flush described in the process statement. The empirical design information includes:

- All data values present are integer data
- The selector switch is in the rinse position and the tank is filled with water and then drained. The mixer is used throughout the cycle.
- Outputs are mixer contactor, water drain valve, and water fill valve.

The following Boolean logic should be used in the ladder design

- Mixer contactor = rinse selected AND low level float switch
- Rinse water fill valve = start bit AND rinse selected AND NOT high level float switch AND NOT rinse water drain valve
- Rinse water drain = start bit AND rinse selected AND high level float switch (sealed with rinse water drain valve XIC instruction) AND low level float switch

(20marks)

Question 3 (20 marks)

Design a ladder logic that could be used to control the three phase change over switch contactor by PLC. The general purpose of change over contactor system in electrical installation 3 phase to distribution board and standby generator. The function of change over contactor is back up supply in essential load. The circuit change over contactor system is done in automatically. This will be able to support the two uninterruptible power supplies, operating in conjunction with diesel generators sets with one essential load. Use the given below block diagram.

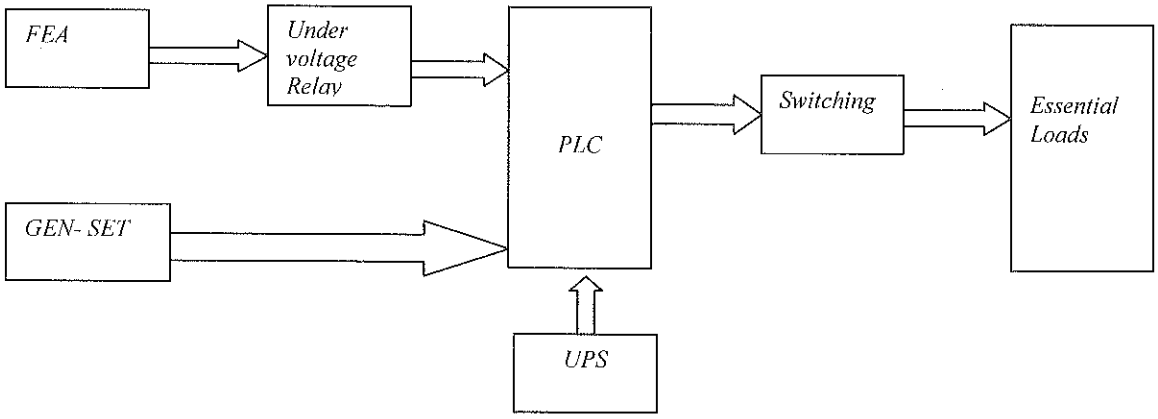

Figure: 2 Distributed Generation Network

The End…