



COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY

**SCHOOL OF ELECTRICAL & ELECTRONIC  
ENGINEERING**

**BACHELOR OF ENGINEERING (HONORS) (ELECTRICAL ENGINEERING)  
YEAR 4**

**EEB851 –INDUSTRIAL AUTOMATION**

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

**SEMESTER 1 - 2019.**

**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!***

**Question 1**

**[Total 10marks]**

- a) Explain the fundamentals of discrete digital input/output and continuous analog input/output the basics of automation. (4marks)
- b) Explain the operational difference between the two electrical scheme given figure 1.

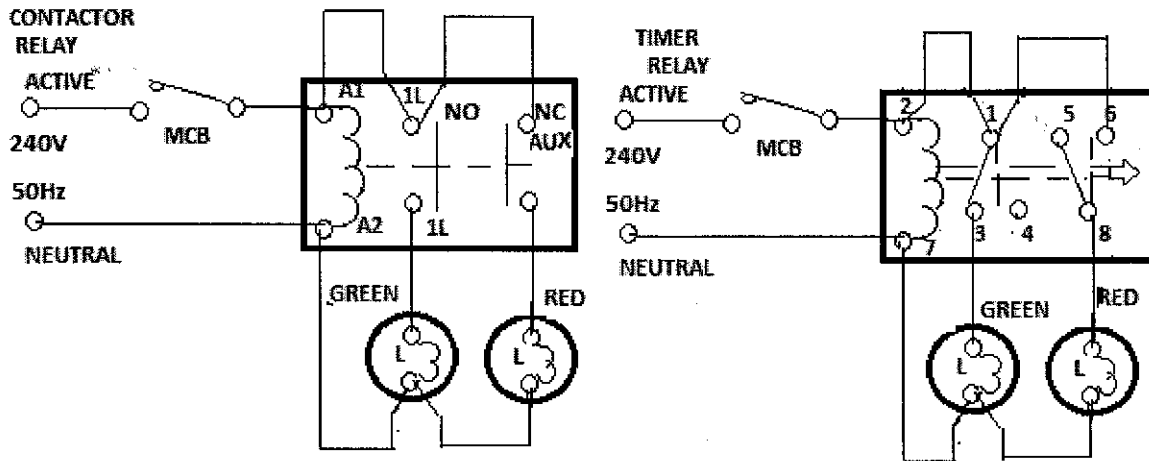


Figure 1: Electrical scheme for contactor and timer.

**(6marks)**

**Question 2**

**[Total 35marks]**

- a) Design and program using ladder logic for starting a 3 phase induction motor. The starter has one start and one stop switch. Both of the switches are momentary contact, start switch is normally open while stop switch is normally close. Output relay, C1, controls the 3-phase supply to the motor. The motor has a stop and a run indicator lights. Illustrate the hardwiring using M340plc. (5 marks)
- b) Unity Pro is able to use the five IEC standard languages name those five languages. (5marks)
- c) 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 pump using direct online starter. Use low level and high level sensor to monitor the flow rate and run valve for supplying the water to consumer mains. Ensure that the tank does not run empty or overflow using the unity pro M340 plc. Assume all the inputs and outputs are discrete. Write input and output address. Illustrate the hard wiring using M340 plc clearly by identify the control and power circuit. (15marks)
- d) The function block PI\_B depicts a PI-algorithm with a mixed structure (series/parallel). Its functions derive from function block PIDFF. These functions enable the function block to perform most classical control applications, without compromising user friendliness or using too many system resources. Write a program using FDB to control the temperature. (10marks)

**Question 3****[Total 30marks]**

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

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

**(5 marks)**

- b) Write the program using FBD to control the speed of the induction motor using PIDFF function. Create two sections, one for the LAG Filter and other for PIDFF function. The simulation should be displayed using the operator screen. Assume all parameters for the two function and display the necessary variables that should be visible in the operator screen for viewing the data. **(8 marks)**
- c) Write the sequential flow chart (SFC) for the simple process which use incremental counter for updating the counting for a given process. The program should have SFC section containing two states X1 and X2, two transitions and also the auxiliary ladder program section for the counter. **(10 marks)**
- d) Briefly explain about SCADA systems. **(2 marks)**
- e) Briefly explain how the new project is created in the Citect explorer SCADA. **(5 marks)**

**Question 4****[Total 25marks]**

- a) Design a ladder logic using M340 that will control a forward and reversing of a 3 phase induction motor. Sketch the control and power circuit using the PLC control. **(10 marks)**
- b) Design the ladder logic for the starting of induction motor in star and delta configuration. Use the digital discrete counter that can be used to count the number of turns for the running of 3 phase induction motor. **(15marks)**

All the Best  
The End...