



MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2023/2024 ACADEMIC YEAR

**FOURTH YEAR SECOND SEMESTER EXAMINATION FOR BACHELOR
OF SCIENCE IN ELECTRICAL AND ELECTRONICS ENGINEERING**

EET415: PROGRAMMABLE LOGICAL CONTROLLERS

DURATION: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

1. Answer Question one and any other two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

- a) Define the ladder and SFC languages (2marks)
- b) Define the PLC and list its components (3marks)
- c) What is the difference between SCADA and DCS (3marks)
- d) Drive the ladder diagram for the shown project in the figure. If the button without cap the cylinder A push it out, else it continuous in its direction. (7marks)
- e) Explain how current the relays and contractors work (3marks)
- f) Design the ladder diagram for a packing control line in figure if, where when PB1(START push button is pressed, the box conveyor moves. Upon detection of the box present, the conveyor stop and apple conveyor starts. Part sensor will count 10 apples. Apple conveyor stops and the box conveyor starts again. Counter will be reset and operation repeats until PB2 (stop push button) is pressed.
- g) What is the ladder diagrams equivalent for figure 1g (4marks)

SECTION TWO: ANSWER ANY TWO QUESTIONS

QUESTION TWO (20 MARKS)

- a) What are the types of buses in PLC (3marks)
- b) Write the Boolean representation of this PLC program (2marks)
- c) What are the 3 types, advantages, disadvantages and applications of sensors. (3marks)
- d) Drive the ladder diagram for the given figure id and s2 is used to defect the larger bottle.
- e) Drive the ladder program for the following project suppose we have a full automatic washing machine, it consists of a pump in to fill the tank of the machine until SH limit sensor gives a signal. Powder sensor to detect the powder soap. Temp switch to choose a degree of heating, heater to heat the water, thermos sensor to achieve the required temperature. Fan, which is rotated the washing by motor it takes 20 minutes. After that pumps out get out the dirty water until the limit sensor gives a signal dryer is used for drying the clothes by rotating the drying motor for 5 minutes. (9marks)

QUESTION THREE (20 MARKS)

- a) Define the micro controller? (1marks)
- b) What are the various classification of sensors/transducers and give two example for each classification. (5marks)
- c) Design the ladder diagram for project in figure 3 where; at the beginning of the assembly line a certain production line boxes are pushed, provided with a barcode and then transferred to a roller conveyor to another part of the operation. With the switch SI on the ON position, the execution is started. If all cylinders are in their initial position near end, Sensor B1 recognizes the existence of a box from the stock and the photoelectric carrier S indicates free passageway, then cylinder IA pushes the box until sensors 1 s 2 indicates reaching the stop limit. Then cylinder 2A is moved downwards and remains two seconds in the front end position at 2s2. At this time, the barcode is printed and afterwards cylinder 2A is moved upward. If the sensor 2s1 indicates that cylinder 2A has reached the near end position, engine M is switched on and the box is carried to the diagonal roller race. If the photoelectric barrier recognizes that the box has left, the limit. Stop with cylinder 3A is moved forward again. Then the control execution is repeated constantly, until with the key-operated switch S/ is switched off again. If a disturbance appears during the operation, the sequential diagram can be brought with the RESET in the initial position.

QUESTION FOUR (20 MARKS)

- a) List the most important blocks used in programming and explain how it works. (2marks)
- b) What are the types of cylinders and explain how they work. (3marks)
- c) List the several language used in PLC programming (2marks)
- d) What are the types of memories PLC (1mark)
- e) Design the ladder diagram for project in figure 4e where; open V valve for 8 seconds to fill the pattern. Lamp turns on when the pattern enters left the fun. Pump gives spray to the pattern only when S₄ detects a pattern over it. When three patterns arrive to S₅, cylinder B pushes them to fall into the box.