



TECHNICAL UNIVERSITY OF MOMBASA

School of Engineering and Technology

Department of Mechanical and Automotive Engineering

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY (MECHANICAL AND AUTOMOTIVE ENGINEERING)

TMC 4413: AUTOMATION FOR MANUFACTURING PLANTS

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2024

TIME: 2 HOURS

DATE: AUGUST 2024

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **five** Questions; Question ONE is compulsory. In addition attempt any Other TWO Questions.

Do not write on the question paper.

Question ONE (Compulsory 30 marks)

- a) Explain the term Automated manufacturing systems [2 marks]
- b) With the aid of a diagram explain the following types of automation systems [12 marks]
- i) Fixed automation
 - ii) Programmable automation
 - iii) Flexible automation
- c) Briefly explain the difference between a microprocessor and a micro controller [5 marks]
- d) **Figure Q1d** is a car parking area where the entry is gate Q0 and exit gate Q1. On entry there are two sensors, I0 outside and I1 inside. On exit also there are two sensors I2 and I3. When car comes in front of I0 sensor, gate Q0 is open. When car reaches to I1 sensor, nothing will happen. When car crosses sensor I1 then gate Q0 will be closed and it would be count up. Inside parking area when car reaches to sensor I2, exit gate Q1 is open. When car crosses I3 sensor then Q1 is closed and it would be count down on display to show the present number of cars inside parking area. Maximum 10 cars will be parked. When parking is full and 11th car comes in front of entry I0, entry gate should not get open. Devise a ladder diagram for the parking.

CAR PARKING AREA

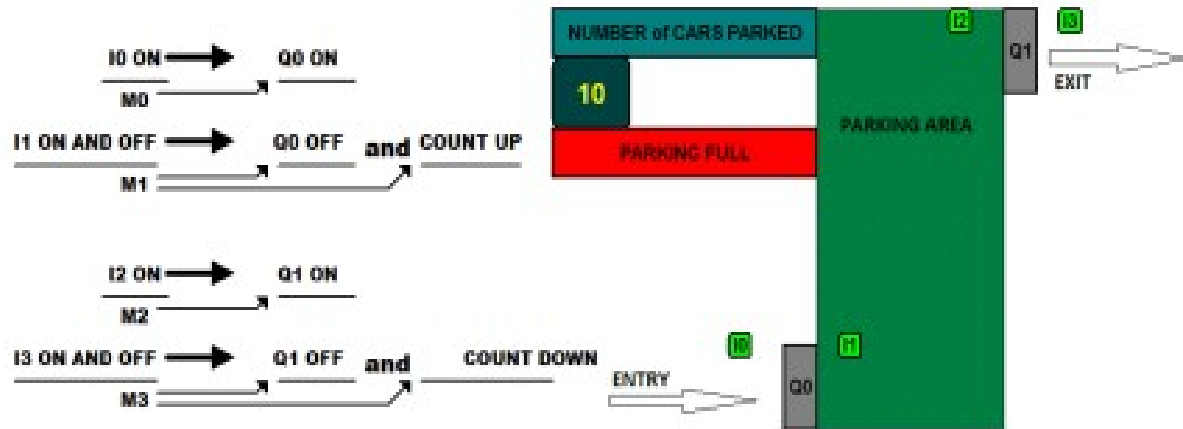


Figure Q1d

Question Two

- a) (i) Define the term Computer-integrated manufacturing
 (ii) State **four** the functions of computer integrated manufacturing [8 marks]
- b) The design a burglar alarm for a house is such that when activated an alarm and lights will be activated to encourage the unwanted guest to leave. This alarm is activated if an unauthorized intruder is detected by window sensor and motion detector. The basic operation of the alarm system and the inputs and outputs of the controller are as follows:

The inputs and outputs are chosen to be;

A = Alarm and lights switch (1 = on)
 W = Window/Door sensor (1 = OK)
 M = Motion Sensor (0 = OK)
 S = Alarm Active switch (1 = on)

The basic operation of the alarm can be described with rules.

1. If alarm is on, check sensors.
2. If window/door sensor is broken (turns off), sound alarm and turn on lights

Required for this alarm system:

- (i) The truth table
- (ii) The Boolean equation
- (iii) Logic circuit diagram
- (iv) PLC program in
 - (I) Ladder logic

- (II) Functional Block Diagram (FBD)
- (III) Statement List (STL)

[12 marks]

Question Three

- a) A control valve has a linear variation of opening as the input varies from 0 – 10 V. a microcomputer outputs an 8 – bit word to control valve opening using an 8 – bit DAC to generate the valve voltage. Determine;
- (i) The reference voltage required to obtain a full open valve
 - (ii) The percentage of the valve opening for a 1 bit change in the input word
- b) With the aid of diagram explain the construction and principle of operation of R – 2R digital to analogue converter.

[6 marks]

[14 marks]

Question FOUR

- a) Outline any **four** advantages of Programmable Logic Controller over relay logic automation
- b) With the aid of a diagram explain the parts of a programmable logic controller

[8 marks]

[12 marks]

Question FIVE

- a) Explain the following as applied to microprocessor
- (i) Accumulator
 - (ii) Flag register
 - (iii) Stack pointer
- b) With the aid of diagram explain the components of a digital control system

[6 marks]

[14 marks]