TEVETA

Technical Education Vocational and Entrepreneurship Authority

DIPLOMA IN BIOMEDICAL ENGINEERING

LEVEL 6 YEAR III EXAMINATIONS

FINAL INTEGRATED SUMMATIVE EXAMINATIONS

SITTING: NOVEMBER / DECEMBER 2025

SUBJECT: INDUSTRIAL MOTOR CONTROL

TIME: THREE (3) HOURS **TOTAL MARKS: 100**

PASS MARK: 50

INSTRUCTIONS TO CANDIDATE

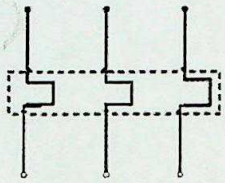
1. Write your Examination number and National Registration Card (NRC) number on the answer booklet provided. Ensure you append your signature in the space provided on the answer booklet.
2. Write the ANSWER SCRIPT SERIAL NUMBER on the examination register and on the entry slip.
3. There are EIGHT (8) questions in this paper. Question one (1) is compulsory, answer FOUR (4) questions from the remaining SEVEN (7) questions.
4. Diagrams may be used where necessary to clarify your answer.
5. Cell phones and programmable calculators are not allowed in the examination room.

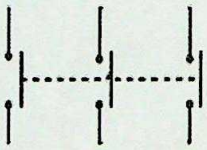
DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

QUESTION 1 (COMPULSORY)

a) Identify the symbols given below: [10 Marks]

i) 

ii) 

iii) 

iv) 

v) 

b) Draw the symbols of the following components:

i) Emergency Pushbutton [2 Marks]

ii) Limit switch NO/NC [2 Marks]

iii) Flow switch NO/NC [2 Marks]

iv) Foot switch NO/NC [2 Marks]

v) Temperature switch NO/NC [2 Marks]

[TOTAL MARKS 20]

QUESTION 2

a) Explain **five (5)** basic factors to be considered when selecting and installing motor control components for use with particular machines or systems [10 Marks]

b) Differentiate manual from automatic motor control [10 Marks]

[TOTAL MARKS 20]

QUESTION 3

State **four (4):**

a) Types of diagrams used in motor control circuit design [4 Marks]

b) Basic rules that apply to schematic diagrams [8 Marks]

c) Motor starting methods used in industrial motor control [8 Marks]

[TOTAL MARKS 20]

QUESTION 4

a) Derive the Boolean expression and truth table of the logic circuits given in figures 4 a, b and c) below:

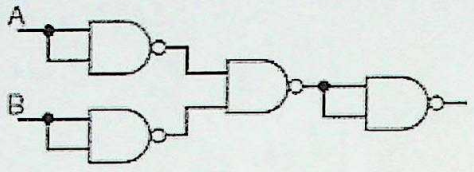


Fig. 4.a)

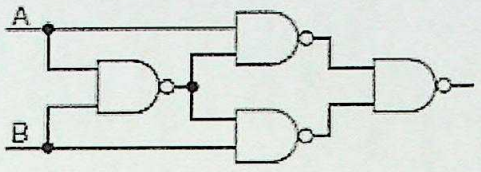


Fig. 4.b) [10 Marks]

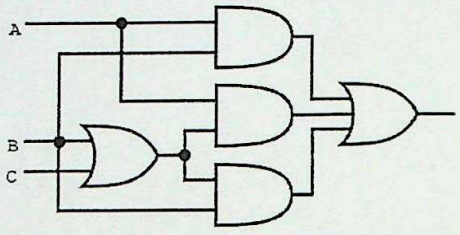


Fig.4.c) [10 Marks]

[TOTAL MARKS 20]

QUESTION 5

a) State **four (4)** programming languages used in PLC [8 Marks]

b) Convert the circuit in figure 6 given below into any of the two (2) languages stated in 5(a) above

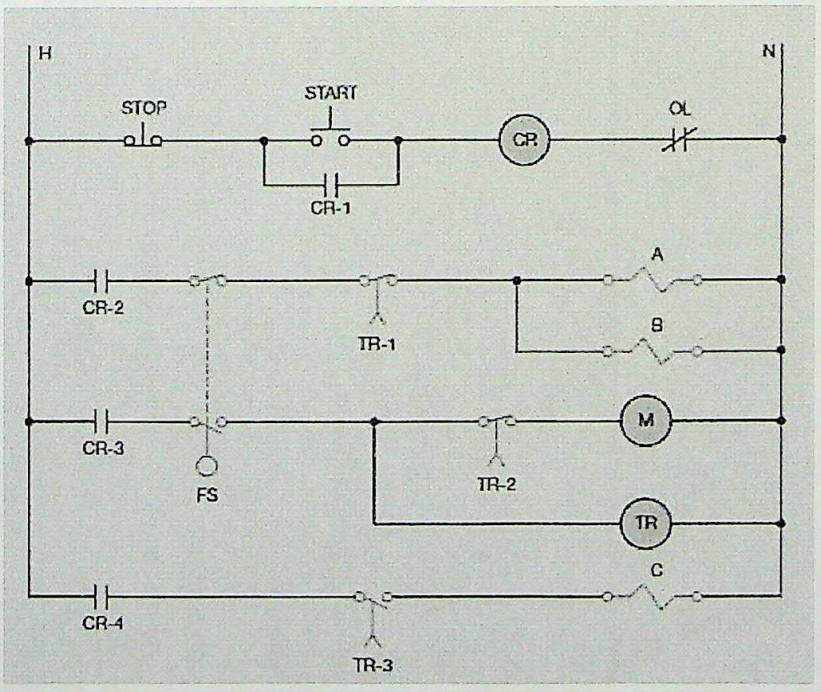


Figure 6: Control circuit [12 Marks]

[TOTAL MARKS 20]

QUESTION 6

a) State **five (5)** advantages and **five (5)** disadvantages of a PLC over a hard wired circuit.

[10 Marks]

b) Describe the hardware construction of a Programmable Logical Control (PLC) [10 Marks]

[TOTAL MARKS 20]

QUESTION 7

a) Explain the operation of the circuit in fig 7 below. [10 Marks]

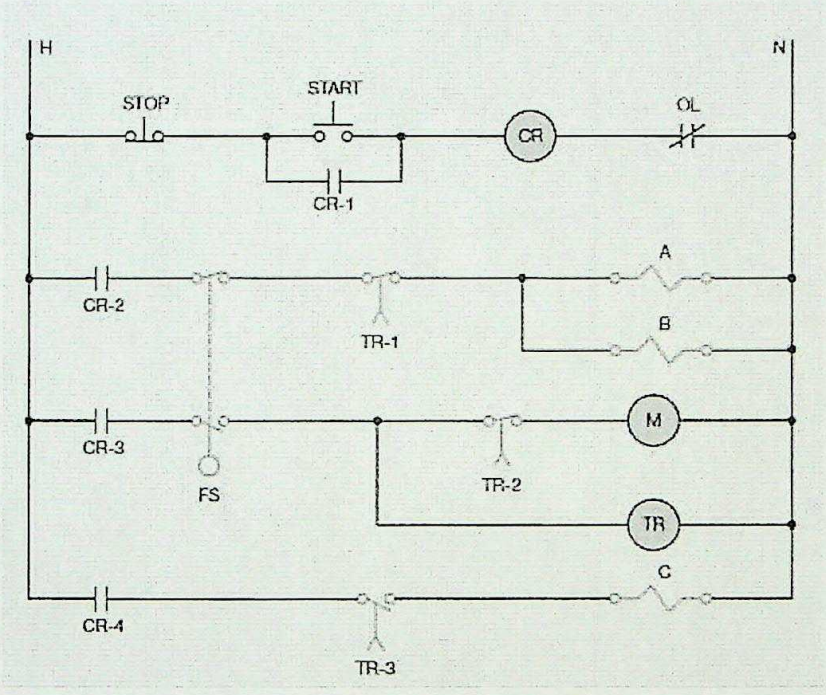


Figure 7: control circuit

b) Descrbe **five (5)** advantages of using the Star/Delta starter motor control circuit. [10 Marks]

[TOTAL MARKS 20]

QUESTION 8

Design both the Power and control circuit for the following operation

a) When the isolator and the triple pole MCB are closed the circuit can then be energized.

b) When the start button is pressed contactor coil M, Timer coil T are energized resulting in the normally open contact of Timer T, instantly closing and energizing contactor coil N.

c) The pressing of the start push button energizes both contactors M and N and both motors start running at the same time. When both motors start running the indicator lamps (yellow lamp and green lamp) both come ON at the same time.

d) When the stop P.B is pressed motor No. 1 stops immediately (Coil M de-energizes) and the yellow indicator lamp goes off, while motor No. 2 comes to a stop after some time (depending on the set time on the Timer T) and the green indicator lamp goes off as well

e) In an event of an overload on motor No.1, motor No.1 will stop instantly while motor 2 will only stop after a time delay of four (4) seconds. In an event of an overload of motor No. 2 both motors will stop immediately [20 Marks]

[TOTAL MARKS 20]