UNIVERSITY OF JOHANNESBURG

PROGRAM	:	*BACHELOR OF ENGINEERING TECHNOLOGY*: ELECTRICAL
SUBJECT	:	**Automation A3 – Supplementary**
CODE	:	**AUTELA3**
DATE	:	July 2019
DURATION	:	180 minutes
WEIGHT	:	40 : 60
TOTAL MARKS	:	100

ASSESSOR	:	Mr. Johan Venter
MODERATOR	:	Dr. J.W. Lambrechts
NUMBER OF PAGES	:	9 PAGES (Cover Page Including)

INSTRUCTIONS TO STUDENTS

PLEASE ANSWER ALL QUESTIONS ON THE QUESTION PAPER.

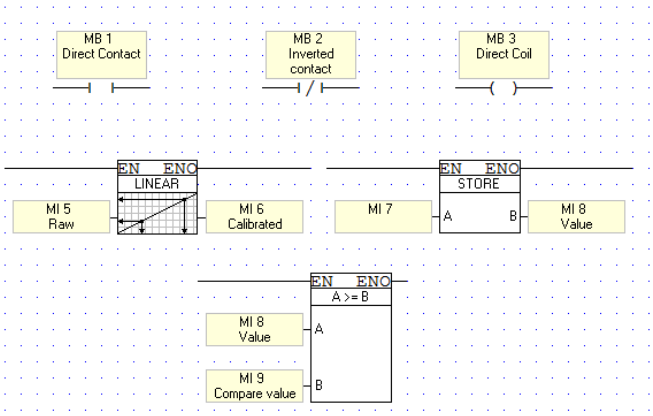
ONLY ONE POCKET CALCULATOR PER CANDIDATE MAY BE USED.

QUESTION 1 [49]

1.1 Design a PLC program that performs the following functions. TAKE NOTE OF THE FOLLOWING SEQUENCE OF EVENTS using Visilogic. (15)

- The application is flow measurement of a magnetic flow sensor
- The system needs to be switched on by the power-up bit (**SB2**)
- Input to the PLC is provided by the analogue 3 input (**MI0**)
- The input is a 12 bit input
- Flow rate is from 3 m^3/s to 30 m^3/s. Save the calibrated value in **MI1**
- The system needs to verify the flow rate every 15 seconds. Be careful in your selection here
    - Separately for this linearization block, state the following values
        - X1, X2, Y1, Y2, X, Y
- At the user's request, the power can be cut to the system at any time. For this to occur, **I0** must be switched OFF.

The only blocks that may be used is the ***Direct Contact***, ***Inverted Contact***, ***Direct Coil***, ***Compare***, ***Linearization*** and ***Store***. No other blocks may be used. Examples of these blocks are given below.



1.2 Name and discuss characteristics of two timers in Visilogic (6)

1.3 On an HMI screen, after programming where a user has to use the screen, answer the following.

1.3.1 For a numeric variable, is there an option to use a keypad entry to enter a number? (2)

1.3.2 For a tankgraph variable, why do we set min and max parameters? (2)

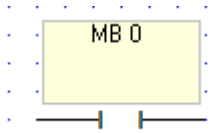
1.3.3 For a numeric variable, why can't an MB variable be used? (2)

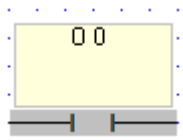
1.4 List the combined 5 steps/procedures of a Drum Sequencer function block (5)

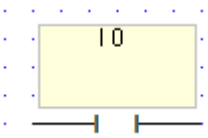
1.5 What is the function of the online test (blue glasses)? Why is it primarily used? (2)

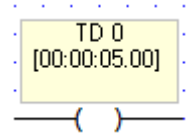
1.6 Can the memory space of a timer be used as is in calculations? If not, what must be done to use the current value of the timer? (3)

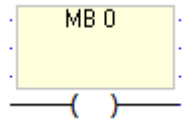
1.7 Name the ladder element in the picture as well as the type of memory element for each case (12)

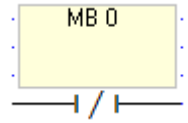
a. 

b. 

c. 

d. 

e. 

f. 

QUESTION 2 [18]

2.1 List three types of control response lags. (6)

2.2 Sketch the circuit diagram for **Derivative Control**. (3)

2.3 Sketch the block diagram showing how feedforward control is implemented. (5)

2.4 Explain what surging is in turbine compressors. (4)

QUESTION 3 [5]

3.1 Explain what split-range control is (a diagram must be used in your answer). (5)

QUESTION 4 [18]

4.1 List 6 advantages of **Digital Communication Protocol** (6)

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4.2 Sketch the Ring and Star network topologies. (6)

4.3 Sketch the Profibus DP and PA terminators (6)

QUESTION 5 [10]

5.1 Sketch the diagram (including labels) to illustrate the different phases of water. (4)

5.2 Define and describe **Electrical Conductance**, **Electrical Conductivity** and **Cell Constant**? (6)

TOTAL of the Paper = [100]