Reg.No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

V SEMESTER B.TECH.(MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOV 2019

SUBJECT: PROGRAMMABLE LOGIC CONTROLLER [MTE 3104]

(22/11/2019)

Time: 3 Hours MAX.MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Data not provided may be suitably assumed
- Follow the Allen Bradely instruction and notation.

1A. Explain the main function of each of the following major components of a PLC: (a) Processor module (CPU) (b) I/O module (c) Programming device (d) Power supply module **04** **CO1**

1B. List the programming control instructions and explain any two of them. **03** **CO2**

1C. Build a ladder logic program that will turn on the outputs with the binary patterns when the corresponding buttons are pushed, as shown in Table.1C. **03** **CO2**

Table 1C Binary pattern

Outputs						**Inputs**
U	V	W	X	Y	Z	
1	1	0	1	0	0	A
1	0	1	0	0	1	B
1	0	0	1	0	1	C

2A. Name the special and remote I/O modules? **02** **CO2**

2B. Develop internal wiring of source input and sinking output module for two input and output devices of the PLC. **03** **CO1**

2C. Identify the input and output parameters used in the development of PLC programming logic for the batch process plant. Implement according to the logic given below, for the batch process shown in Figure 2C. **05** **CO2**

- Ingredient A is sent to the tank first by energizing solenoid 1. The flow meter gives one pulse for every gallon of flow. Solenoid Valve will be open until 200 gallons have poured in.
- After ingredient A is in the tank, 200 gallons of ingredient B should be added. The process of adding follows the same procedure as ingredient A.

- Once step 2 is done, the mixer motor starts and runs for 10s.
- After mixing is complete, solenoid 3 should open, let the mixed batch goes to the finished tank.
- When the tank is empty, the low-level sensor turns ON to open solenoid 3 to close and restarts the process again.
  (Note: one gallon is equal to one count)

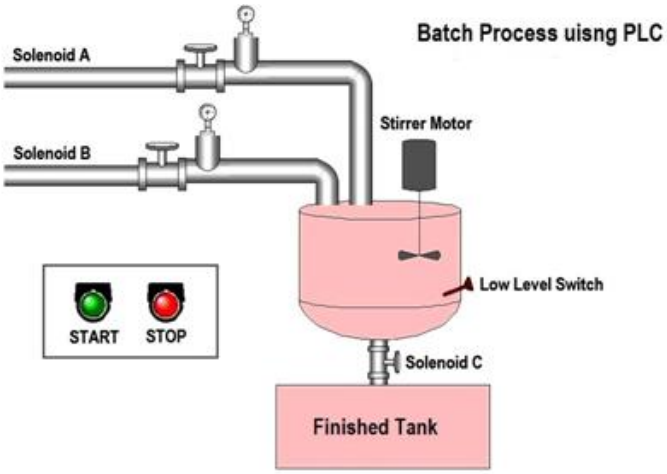

Figure 2C Batch process plant

3A. List the two advantages of using programmed PLC timers over mechanical timing relays. Then, develop a program that will latch on an output B, 20 seconds after input A has been turned on. After A is pushed, there will be a 10-second delay until A can have any effect again. After A has been pushed three times, B will be turned off. **04** **CO2**

3B. Define and Illustrate the timing diagram of the RTO with example. **03** **CO2**

3C. Construct a ladder program that will start when input '*A'* is turned on and calculate the series given below. The value of *n* will start at one, and with each scan of the ladder logic '*n'* will increase until n=100. While the sequence is being incremented, any change in '*A' will* be ignored. **03** **CO2**
(Where A=I:0.0/0;n=N7:0;x=N7:1)

Series: x=2(n-1)

4A. Develop ladder logic for the given statement **04** **CO2**

a) A conveyor is run by switching on or off a motor. We are positioning parts on the conveyor with an optical detector. When the optical sensor goes on, we want to wait 1.5 seconds, and then stop the conveyor. After a delay of 2 seconds, the conveyor will start again. We need to use a start and stop button - light should be on when the system is active.

b) For the conveyor in the above case, we will add a sorting system. Gages have been attached that indicate good or bad. If the part is good, it continues on. If the part is wrong, we do not want to delay for 2 seconds, but instead actuate a pneumatic cylinder. (Note: For each case, Draw the ladder logic separately)

4B. Define the parameter used in the closed-loop controller? Draw the loop diagram for the tank filling system, as shown in Figure 4B. **04** **CO3**

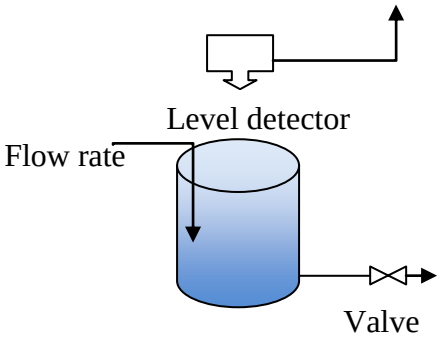

Figure 4B Tank filling system

4C. Define the duplex and name the data transmission used in PLC networking. **02** **CO3**

5A. Illustrate the component levels of architecture on the distributed control system. **03** **CO4**

5B. Differentiate between programming logic controller and distributed control system. **03** **CO4**

5C. Elaborate on the main components of the supervisory control system. **04** **CO3**