Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

V SEMESTER B.TECH. (MECHATRONICS ENGINEERING)
END SEMESTER EXAMINATIONS, JAN 2017

SUBJECT: PROGRAMMABLE LOGIC CONTROLLER
[MTE 3104]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A. Write a ladder logic program for the following process. An output B is to be latched 20 seconds after an input A is pressed. After A is pushed there will be a 10 second delay until A can have effect again. After A has been pushed 3 times, B will be turned off. **04**

1B. What do you mean by DCS? List the different types of DCS with suitable examples **04**

1C. Define interlocking? Explain the concept with an example **02**

2A. Illustrate the functionality of the Up-Down Counter with a neat block diagram, **03**

2B. With relevant sketches briefly explain the concepts of sinking and sourcing with respect to the I/O Modules of PLC **04**

2C. Develop a ladder logic program for the following statement: An output pulse V is to go on 3.5 seconds after an input W is turned on. Time interval for this is to last 7.5sec only. V is to go on again 3 sec later for another 5.3sec. **03**

3A. There are three machines each with individual start and stop buttons. Any one may run at a time. The first one should automatically stop when the second one is switched on. Construct a ladder diagram for this scenario with proper labelling and addressing. **02**

3B. List the benefits of HART protocol. Where does HART find the most use? **03**

3C Elaborate on the different levels of Industrial Control Architecture? Where do the PLCs fit? **05**

4A. Implement a ladder logic circuit for the following scenario with appropriate labelling and addressing,: **05**

- A toggle start switch (TS1) and a limit switch on a safety gate (LS1) must both be on before a solenoid (SOL1) can be energized to extend a stamping cylinder to the top of a part.
- While the stamping solenoid is energized, it must remain energized until a limit switch (LS2) is activated. This second limit switch indicates the end of a stroke. At this point the solenoid should be de-energized, thus retracting the cylinder.
- When the cylinder is fully retracted a limit switch (LS3) is activated. The cycle may not begin again until this limit switch is active.
- A cycle counter should also be included to allow counts of parts produced. When this value exceeds 5000 the machine should shut down and a light lit up.
- A safety check should be included. If the cylinder solenoid has been on for more than 5 seconds, it suggests that the cylinder is jammed or the machine has a fault. If this is the case, the machine should be shut down and a light should be turned on.

4B. Compare the different Jump functions of PLC with ladder logic examples **03**

4C. Design a ladder logic program for the following process: A buffer can hold up to 10 parts. Parts enter the buffer on a conveyor controller by output conveyor. As parts arrive they trigger an input sensor enter. When a part is removed from the buffer they trigger the exit sensor. The conveyor is to be stopped when the buffer is full, and restarted when there are fewer than 10 parts in the buffer. As normal, the system should also include a start and stop button. **02**

5A. With respect to network topologies explain the following terms: **04**
(i) Star Configuration
(ii) Ring Configuration
(iii) Tapped Configuration
Also explain how redundancy may be implemented for the above networks

5B. Simulate the following function using ladder logic. **03**

$$x = \operatorname{atan}\left(y\left(\frac{y+\log(y)}{y+1}\right)\right)$$

5C. Design ladder logic that uses normal timers and counters to measure time of 50.0 days. Note: Measure minutes, hours and days. **03**