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

V SEMESTER B.TECH. (MECHATRONICS ENGINEERING)
END SEMESTER EXAMINATIONS, NOV 2018

SUBJECT: Programmable Logic Controller [MTE 3104]

(26/11/2018)

Time: 3 Hours   MAX. MARKS: 50

Instructions to Candidates:

❖ Answer **ALL** the questions.
❖ Data not provided may be suitably assumed with justification
❖ Draw neat sketches and ladder diagrams with descriptions wherever required

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1A. Explain self-healing ring used in PLC based communication network. **2**

1B. Design a ladder logic to implement a periodic impulse timer of 10 seconds time period using ON delay timer. **3**

1C. In an automatic car parking system, entry and exit of a car is detected by sensors. A PLC will keep a record of number of cars enter and exit. Maximum 50 numbers of cars can be in the parking area. An entry gate (controlled by electric motor) will be kept open only when number of cars in the parking area is less than 50. Design a ladder diagram to control the operation of the entry gate of the car parking system. **5**

2A Design a ladder logic diagram to calculate the angular velocity(RPM) of the ceiling fan with the help of optical sensor(Figure 2-A). **3**

Figure 2-A

2B Explain off delay timer with timing diagram. **2**

2C Design a ladder logic to simulate the operation of a light system (Figure 2-C). The light system consists of three separate lights on each side of machine. Each set of lights will be activated separately, by either the left or right turn signal switch. There is to be a 1-second delay between the activation of each light and a 1second period when all the lights are off. Ensure that when both switches are on, the system will not operate. Use the least number of timers possible. The sequence of operation should be as follows: **5**

Figure 2-C

• The switch is operated.
• light 1 is illuminated.
• light 2 is illuminated 1 second later.
• light 3 is illuminated 1 second later.

• light 3 is illuminated for 1 second.
• All lights are off for 1 second.
• The system repeats while the switch is on.

3A Identify the type of signal transmitted between input terminal and processing unit inside the PLC. Explain the device/component used for the same. **2**

3B Describe the operation of JSR instruction in PLC ladder logic. **3**

3C When the lights are turned off in a building, an exit door light is to remain on for an additional 2 min, and the parking lot lights are to remain on for an additional 3 min after the door light goes out. Design a ladder program to implement this process. **5**

4A Explain the system architecture of SCADA with proper block diagrams. **3**

4B Design a ladder diagram to generate a 0.1 Hz frequency waveform with 60% duty cycle at digital output terminal when toggle switch is ON. **4**

4C Design a ladder logic to implement process(Figure 5-B) described as- **3**

• There are 3 groups participating in the quiz game: pupils, high school students and professors. If they want to get the chance of answering the question from the host, they must press the answer button on their table first. Other groups' pressing will be invalid if any group gets the chance successfully

Figure 5-B

• There are two answer buttons for the pupil group and professor group and one answer button for the high school student group. In order to give preferential treatment to the pupil group, Y0 will be ON if any one of X0 or X1 is pressed. However, in order to limit the professor group, Y2 will be ON when X3 and X4 are pressed at the same time. For the high school student group, Y1 will be ON when X2 is pressed.

• If the host presses X5 (Reset button), Y0, Y1 and Y2 will be OFF.

5A Describe different levels of industrial control. Explain group control in detail. **5**

5B Consider an application where an integer number between 1 and 100 is entered into the PLC by pressing the pushbutton 'P'(For example: if the number to be entered is 5 then press the pushbutton 5 times). Develop a ladder logic to glow G_LED if the entered number is divisible by 2,3&5 and glow R_LED if the entered number is greater than 100. **5**
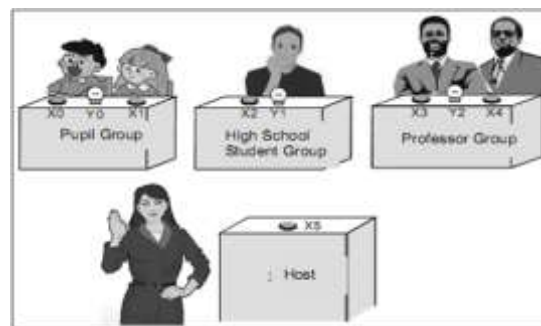
(*Note: Number of RUNGS in the ladder must NOT exceed 5*)