MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

IV SEMESTER B.TECH. END SEMESTER EXAMINATION

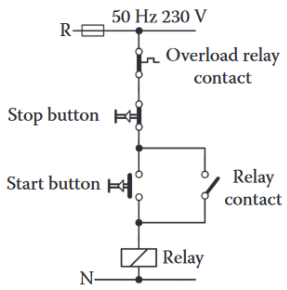
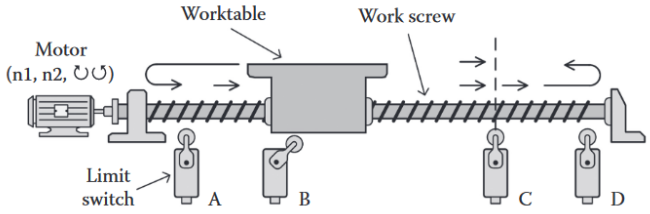
MAY 2024

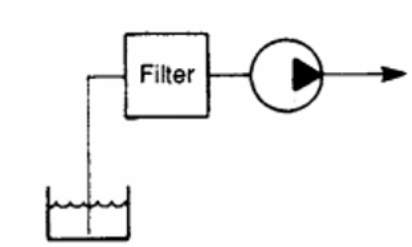
SUBJECT: INDUSTRIAL AUTOMATION [MTE 2223]

Date of Exam: **9/5/2024** Time of Exam: **02:30 PM – 05:30 PM** Max. Marks: **50**

Instructions to Candidates:

- Answer ALL the questions & missing data may be suitably assumed

Q.NO.	QUESTION	M	CO	PO	LO	BL
1.	Illustrate the various components of an industrial automation system using a suitable diagram.	**2**	**1**	1, 2	1, 2, 3, 16, 18	**4**
2.	Analyze the operation of the simple automation circuit shown in the figure Q2 below.  Figure Q2	**3**	**1**	1, 2	1, 2, 3, 16, 18	**4**
3.	Analyze the operation of the system shown in the figure below. Deduce the working based on the automation components shown in the figure Q3. Here, the motor can run at two speeds, n1 and n2 in the clockwise and anti-clockwise directions.  Figure Q3	**5**	**1**	1, 2	1, 2, 3, 16, 18	**4**

4.	Illustrate and explain the compressor air distribution system in a Pneumatic actuation system.	**2**	**2**	1, 2, 3, 7	1, 2, 3, 16, 18	**4**
5.	Consider the diagram of the filter in a hydraulic system shown in Figure Q5 below.  Figure Q5 Analyze its operation and differentiate its operation from a return line filter using a suitable diagram.	**3**	**2**	1, 2, 3, 7	1, 2, 3, 16, 18	**4**
6.	Asses the construction and working of a. 5/2 directional valve b. 4/2 directional valve using a sketch and its working principle.	**5**	**2**	1, 2, 3, 7	1, 2, 3, 16, 18	**5**
7.	A digital output (Q2.0) of a PLC must be energized when either one of two digital inputs I1.0 and I1.1 or both, have been activated. Two different programmers wrote the following LAD programs. Examine if the two programs are quite equivalent.  	**2**	**3**	1, 2, 3, 7	1, 2, 3, 16, 18	**5**
8.	Create a LAD program for the following automatic mixing machine (Figure Q8) according to the specifications (Table Q8) given: Automatically infusing the container with liquids A and B in order when START is pressed. When it reaches the set level, mix the two liquids evenly, then open the valve to let out the mixture.	**3**	**3**	1, 2, 3, 7	1, 2, 3, 16, 18	**6**

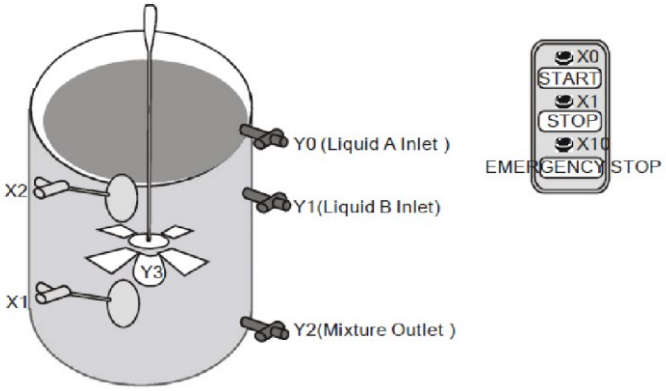
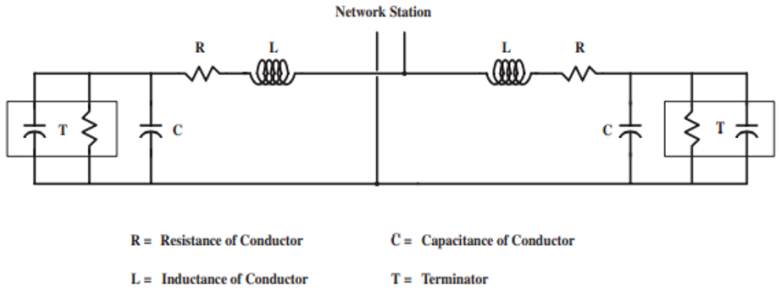


Figure Q8

Table Q8

Device	Function
X0	X0 = ON when START is pressed.
X1	Low level float sensor. X1 = ON when the liquid level reaches X1.
X2	High level float sensor. X2 = ON when the liquid level reaches X2.
X10	EMERGENCY STOP button. X10 = ON when the button is pressed.
T0	60 sec timer. Time base: 100ms
T1	120 sec timer. Time base: 100ms
Y0	Liquid A inlet
Y1	Liquid B inlet
Y2	Mixture outlet
Y3	Agitator

9.	A mixing machine includes a central motor and a number of sensors that are necessary for its operation. The motor C1 is switched on by pressing the START button, AND the material level sensor is activated, AND the water level sensor is also on. The machine stops operation if any of the two STOP push-buttons are pressed, OR if the temperature sensor is activated, OR if the thermal sensor of the motor is activated. Create a PLC ladder diagram for the operation of this machine.	**5**	**3**	1, 2, 3, 7	1, 2, 3, 16, 18	**6**
10.	Illustrate the various layers of the ISO/OSI model and explain the working of the different layers.	**2**	**4**	1, 2, 3, 7	1, 2, 3, 16, 18	**4**
11.	You are designing a subnet mask for the 192.168.239.0 network. You want 7 subnets with up to 26 hosts on each subnet. Deduce what subnet mask should you use,	**3**	**4**	1, 2, 3, 7	1, 2, 3, 16, 18	**4**
12.	The figure Q 12 below shows the circuit diagram of a transmission line. Deduce the operation of the same.	**5**	**4**	1, 2, 3, 7	1, 2, 3,	**4**

	 Figure Q12				16, 18	
13.	Discuss the operation of the AS-i communication protocol in detail with suitable diagrams with reference to its wiring and application.	**2**	**5**	1, 2, 3, 7, 12	1, 2, 3, 5, 16, 18	**4**
14.	Discuss the hardware and software architecture of a SCADA system in detail with examples for each instance.	**3**	**5**	1, 2, 3, 7, 12	1, 2, 3, 5, 16, 18	**4**
15.	Create a LAD diagram, state diagram and HMI diagram for the following operation. One complex industrial machine is operating by utilizing a motor with three speeds. The operation of the machine is achieved through four pushbuttons. The button b0 is for STOP, while the buttons b1, b2 , b3 are for the slow, medium, and high speeds, correspondingly. Moreover, we would like to have the medium speed to be commanded only if the motor is operating in slow speed before, and the high speed to be commanded only if the motor is operating in the medium speed before.	**5**	**5**	1, 2, 3, 7, 12	1, 2, 3, 5, 16, 18	**6**