



MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

SIXTH SEMESTER B.TECH. (INSTRUMENTATION AND CONTROL ENGG.) END SEMESTER DEGREE EXAMINATIONS, JUNE - 2018

SUBJECT: INDUSTRIAL AUTOMATION [ICE 3201]

Duration: 3 Hour

Max. Marks:50

5

3

2

4

4

3

Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitably assumed.
- 1A Develop the supervisory control flowchart of a system to increase the temperature set point (TSP)of a pressure reaction vessel to a new value, TSPNU. The temperature set point is to be increased in steps of 0.2% with a 5-s delay between increases. If the pressure (P) rises above a critical value (PCR), the TSP should be decreased by 0.1% until P falls below PCR. Then set point increases can begin again.
- **1B** With a flowchart explain Linearization.
- **1C** A data-logging system must take samples of 40 variables at 100 samples per second each. What is the maximum signal-acquisition and processing time in microseconds?
- 2A Pressure in psi is measured and converted to a voltage by a sensor according to the relationship, $V = 3.1[p + 10]^{1/2} - 9.8$ The pressure range is 0 to 30 psi and the set point is 15 psi. This voltage is provided as input to an 8-bit unipolar ADC with a 10.00-volt reference, and the resulting binary is provided as input to a control computer. (a) Develop the equations used to find the pressure from the binary input and the error. (b) Contrast the actual error with the computed sample error for a pressure of 17.3 psi.
- **2B** Using a neat block diagram, explain the internal architecture of a PLC.
- **2C** For the following Boolean equation: $X = A + B(A + C\overline{B} + D\overline{A}C) + ABCD$ Write the ladder logic for un-simplified equation and compare it with that for the simplified equation. 2
- **3A** With a neat timing diagram, explain retentive ON delay timer.

3B	Write	a ladder logic for the dead man switch. Dead man switch consist of two push buttons (GO		
	and STOP) and a motor. The GO button will start the motor, and the STOP button will stop it.			
	If the	If the STOP button was used to stop the motor, the GO button must be thrown twice to start the		
	motor. When the motor is running, a light should be turned on.		3	
3 C	Write instruction list and ladder logic program for the below conditions.			
	I.	When button A is pressed, a light will flash for 5 seconds.		
	II.	The flashing light will be on for 0.25 sec and off for 0.75 sec.		
	III.	If button A has been pressed 5 times the light will not flash until the system is reset.	4	
	IV.	The system can be reset by pressing button B.	4	
4 A	List a	ny six structured text commands which are used in Programmable logic controllers.	3	
4 B	Imple	ment the following function using ladder logic		
		$x = \operatorname{atan}\left(y\left(\frac{y + \log(y)}{y + 1}\right)\right)$	3	
4 C	Write instruction list to find sum of the squares of first 50 numbers using for loop.		4	
5A	Discuss about any two main operational modes of HART instruments.			
5B	Descr	ibe local field station of a distributed computer control systems.	3	

5C Illustrate the structure of a RTU frame of MODBUS communication protocol. 3