

MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL

SECOND SEMESTER M.TECH. (CONTROL SYSTEMS) END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: INDUSTRIAL AUTOMATION [ICE 5248]

Time: 3 Hours

MAX. MARKS: 50

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- ✤ Answer ALL the questions.
- ✤ Missing data may be suitably assumed.

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- 1A. What are the different types of automation systems? Explain.
- **1B.** Draw and explain the automation pyramid.
- **1C.** Define the following: i) Economy of scope ii) Economy of scale.
- **2A.** Explain the OSI model with illustration.
- **2B.** What are the features of RS-232 standard for serial communication?
- **2C.** What is the maximum bit transfer rate, signal voltages and cable length of RS-485 standard?
- **3A.** How analog and digital data is transmitted using HART protocol?
- **3B.** Write down the Modbus message frame structures.
- **3C.** List and explain the elements in the physical layer of the foundation fieldbus.
- **4A.** A temperature control system consists of three Bimetallic Thermostats (Thermostats are deenergized (LOW) when the set point is reached). The system operates three heaters. Thermostats are set at 50, 60 and 70 °C. For the temperature below 50 °C, three heaters have to be ON. For temperature between 50-60 °C, two heaters need to be ON. For the temperature between 60 °C and 70 °C only one heater has to be ON. Above 70 °C, all the heaters should be OFF. A safety shutoff should be energized when the temperature reaches 80 °C which makes all three heaters OFF in case one stays ON by mistake. A master switch turns the system ON and OFF.
- 4B. Draw a ladder diagram for the following problem. A conveyor arrangement is made as shown in the Fig. Q4B. The shutter is operated with a pneumatic valve that takes 10 seconds to move from one position to other. Side A will be opened for the first 15 bags, B for the next 15 bags and that repeats until a main reset switch is enable. Moreover, all conveyors should remain off when the shutter actuator is enabled.

4C.	Draw the flow charts for P, I and D controller modes, with necessary equations.	3
5A.	Explain branching and convergence, in sequential flow charts with examples.	3
5B.	With a neat diagram, explain the architecture of a Distributed Control Systems.	4
5C.	List the arithmetic and data manipulation instructions in PLC.	3



Fig. Q4B