Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: INDUSTRIAL AUTOMATION & CONTROL [ELE 437]

REVISED CREDIT SYSTEM

Time: 3 Hours | 28 NOVEMBER 2015 | MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitably assumed.

1A. Discuss briefly, the role of automation in industry. With suitable examples, explain the different types of automation employed in industries. **05**

1B. With suitable block diagrams, explain the architecture of industrial automation systems **05**

2A. With suitable response graphs, explain the "Adjust and Observe" tuning of a PID controller used in industrial automation. **05**

2B. Explain with an example the feedback system that measures the disturbance and maintains a desired ratio at the process output. **05**

3A. A continuous filling operation requires boxes moving on a conveyor to be automatically positioned and filled as shown in **Figure1 –** all locally controlled by a PLC. Develop suitable ladder logic and timing diagram for the controlled process. **03**

3B. Draw a ladder diagram for a 3 motor system having the following conditions. Motor1 (M1) starts as soon as the start switch is on. After 10 seconds, M1 goes off and Motor2 (M2) starts. After 5 seconds, M2 goes off, and Motor3 (M3) starts. After 10 seconds, M3 goes off and M2 goes on. After 5 seconds, M2 goes off and M1 comes on, and the cycle is repeated. **03**

3C. Explain the working of a retentive type **on delay** timer with help of neat timing diagram. Also develop the PLC ladder logic for flashing an LED continuously with a delay of 1 sec until the stop button is pressed. (Use only one retentive type timer) **04**

4A. A pipe, having 120 mm diameter carries water with a head of 3m. The pipe descends 12m in altitude and reduces to 80mm diameter. The pressure head at this point is 13m. The fluid density is 1000kg/m^3. Assuming no losses, determine:

a) The velocity in the narrow section.

b) The volume flow rate. **03**

4B. For an industrial process involving the transportation of fluid over a pipeline from the source to the storage with suitable flow regulation through linear control valves, with suitable diagrams and graphs, prove that the non-linearity in the effective characteristics of the valve is dependent on the pipeline diameter. **03**

4C. A venturimeter of throat diameter 0.076m is fitted in a 0.152m diameter vertical pipe in which liquid of relative density 0.8 flows downwards. Pressure gauges are fitted to the inlet and the throat regions. The throat being 0.914m below the inlet. Taking the coefficient of the meter as 0.97, find the discharge when –

a) The pressure gauges read the same

b) When the inlet gauge reads 15170N/m^2 higher than the throat gauge. **04**

5A. With a neat diagram, explain the various elements of a Distributed control system (DCS). Also list out the advantages of using DCS for process control. **03**

5B. With suitable diagrams, explain the various components of a Numerical Control System. **03**

5C. The **Figure 2** shown below is that of an Automated Manual Transmission (AMT) of Maruti Suzuki ALTO K10. The car is stationary and the driver intends to go in reverse direction. It is required to apply brake before shifting to reverse gear in case of the AMT. The gear position in this case (shown in figure) is at the NEUTRAL (0000) as sensed by the gear knob position sensor. The brake is currently disengaged (0000) as indicated by the potentiometer attached to the brake pedal.

When brake pedal is pressed, the corresponding output (8V = 1000) is received by the Transmission Control Unit (TCU). Now when the gear knob is pushed towards 'R' (0101), the reverse gear gets engaged. (Aftermath of this is, on pressing accelerator pedal, the vehicle moves in the reverse direction)

Design the signaling process followed on the CAN bus with brake pedal and gear position sensor transmitting data onto the bus. Discuss the concept of bus arbitration in this context. **(Suitable assumptions if any may be made)** **04**

6A. With suitable diagrams, explain the concept of Frequency Shift Keying used to transmit data via the HART protocol. Explain the Point-to-Point as well as Multi-Drop modes of operations of the HART protocol. **05**

6B. Explain the various architectures of the SCADA system employed for the process shown in **Figure 3** **05**

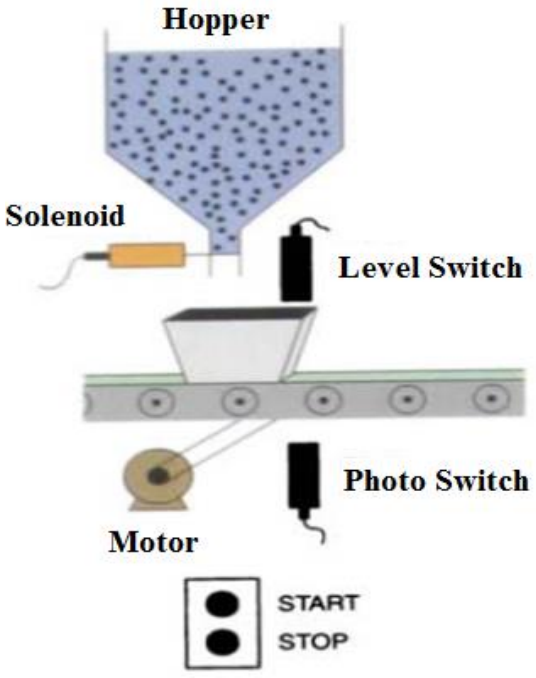

FIGURE 1

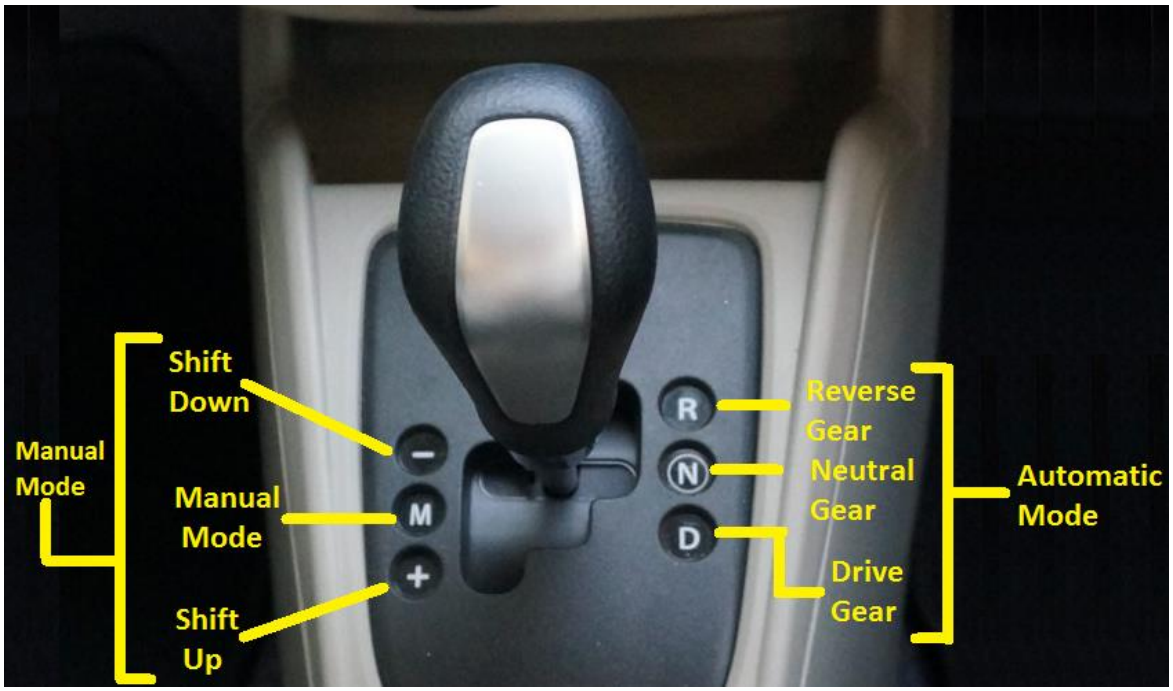

FIGURE 2

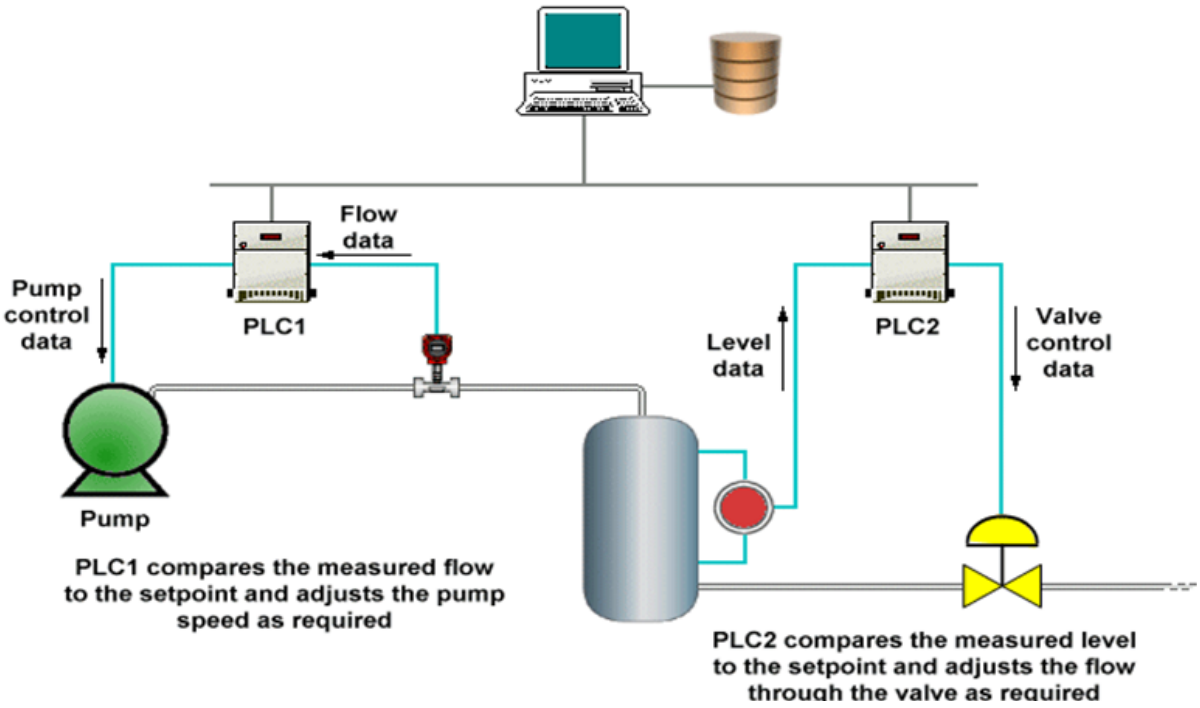

FIGURE 3