Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
400 level 1st Semester Examination June/July 2017
SCT 463-2 Industrial Automation

Uva Wellassa University

Instructions to candidates
Duration: Two (02) hours
Number of questions: Four, (04)
Mark allocation: 100 Mark
Answer all questions

Please note that all dimensions are in mm.

1.

a. State three advantages of automation by giving each, a day to day example.
(09 marks)

b. Briefly, compare the terms semi-automated and fully automated by using an example.
(07 marks)

c. State three basic types of automation and show it in a graph of Quantity vs Variety.
(06 marks)

d. State two disadvantages of automation.
(03 marks)

2.

a. Draw wiring connections of a two wire sensor and a three wire sensor with a PLC and a power source.
(05 marks)

b. State suitable industrial sensors for the following applications
   a. Detect liquid level of a tank.
   b. Detect metallic objects run on a conveyor.
   c. Detect single sheet and double sheet in paper printing machines.
   d. Detect human presence in a robot working cell.
   e. Detect/count traveling distance of a verticle lift.
(05 marks)

3.

a. State main differences between hydraulic circuit and pneumatic circuit in terms of components.

(05 marks)

b. Compare hydraulic and pneumatic system in terms of their advantages and disadvantages.

(05 marks)

c. State five types of positive displacement pump. (05 marks)

d. Figure 01 below shows an automatic material transfer station which is used to transfer highly inflammable materials. Automation needs to be done entirely with pneumatic components. No electronic sensors or solenoid operated valves are permitted due to safety reasons. Draw a pneumatic diagram for the application by considering points given in the next page.

(20 marks)

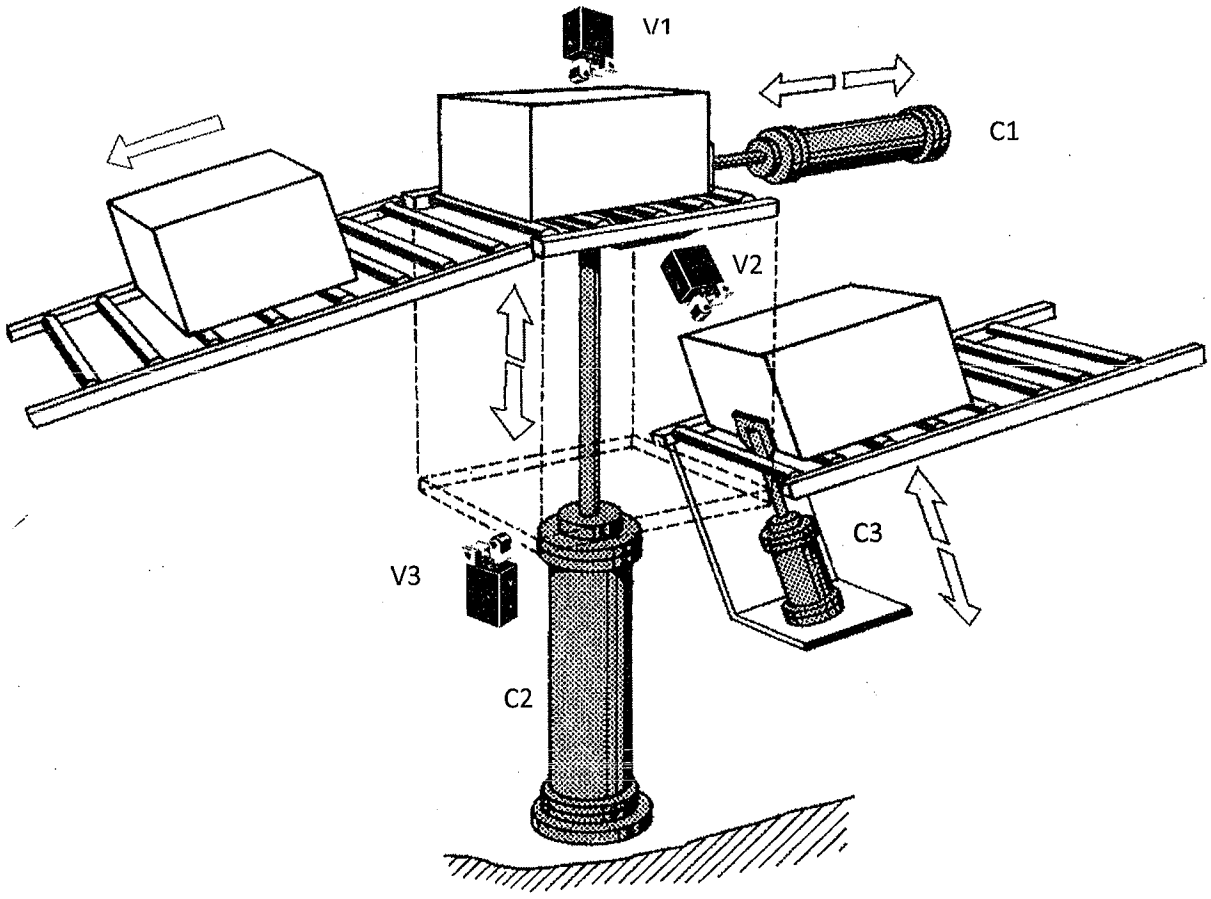

Figure 01

- C1, C2, C3 all are double acting pneumatic actuators.
- V1, V2 are roller lever valve which operates in presence of the box(material been transferred).
- V3 also a roller lever valve operates when the cylinder C2 is in its fully retracted position.
- By default, C1 is in its fully retracted position and C2, C3 are in their fully extended positions.

4.

Figure 02 below shows an automatic welding station. Pre-arranged workpieces (7) are moved on a conveyor(6) and finished products(12) also moves on the same conveyor. Welding torch(9) is stationary. During the operation, workpiece assembly is lifted from the conveyor belt and turned at working speed through 360°. During this time, the suction shield(1) is lowered pneumatically to a point close to the emission. The suction shield is used to extract any toxic fumes generated during welding. The shield is lifted again before the workpiece assembly is moved on, to allow freedom of movement. Total automation needs to be controlled by a PLC. Develop a ladder diagram for the process by considering the points given in the next page.

(30 marks)

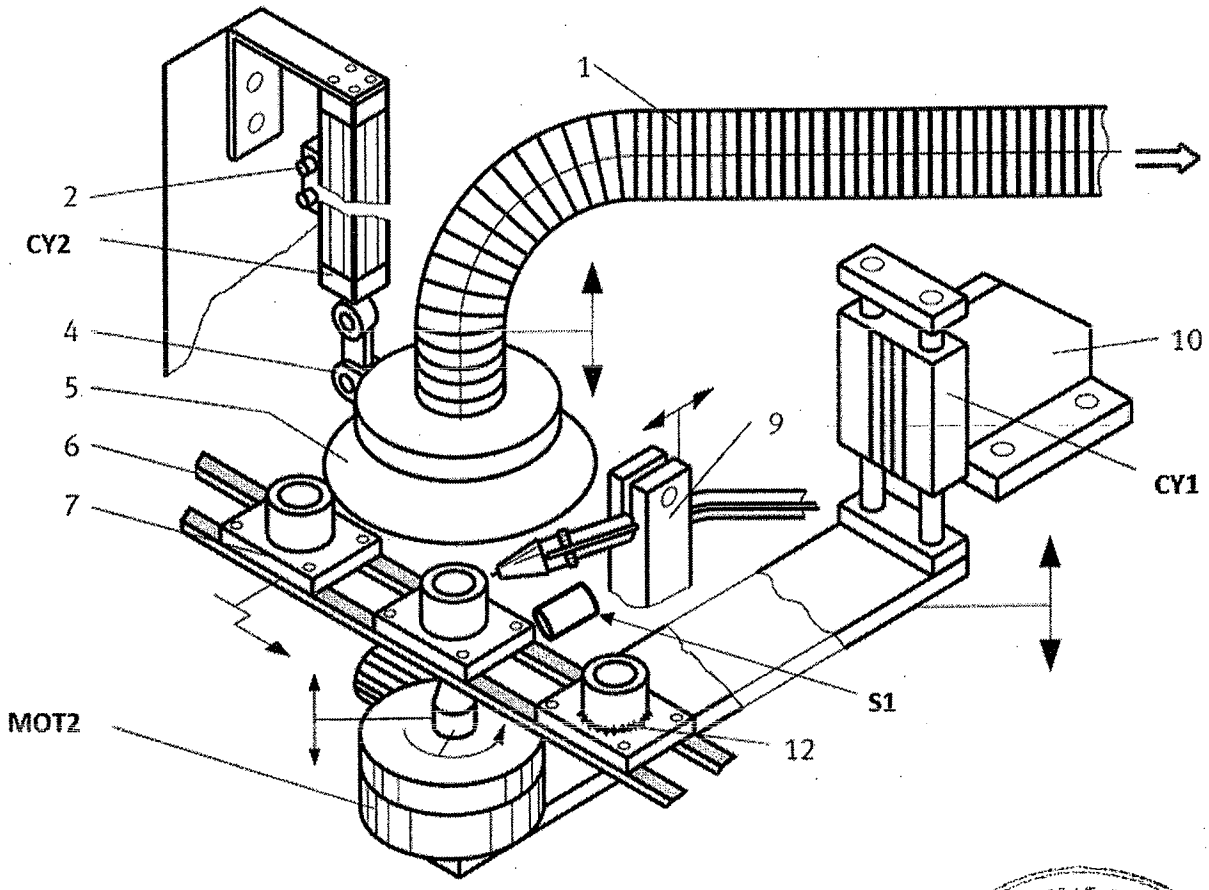

Figure 02

- There are two push buttons named SW1 and SW2 used to start and stop the process consecutively.
- The conveyor is driven by a DC motor named MOT1.
- S1 is a proximity sensor which is used to detect the workpiece and it is mounted so that, when it is triggered workpiece is aligned with the motor MOT2.
- Pneumatic cylinder CY1 used to lift and lower the motor MOT2 and each movement takes 0.5 seconds to complete.
- Welding cycle takes 8 seconds.
- Pneumatic cylinder CY2 takes 0.5 seconds to lower and lift the suction shield.
- Use T0 - T23 timers which have 100ms not accumulating steps.
- Use 4/2 solenoid actuated valves to operate two cylinders as in figure 03 below.
- Clearly, state your assumptions if needed.

Operational Sequence

1. Each workpiece moves along the conveyor and stops above the motor MOT2.
2. Cylinder CY1 lifts the motor MOT2 and motor engaged with the workpiece.
3. Suction shield lowered and welding will start while motor MOT2 rotates the workpiece.
4. Welding is completed, Motor MOT2 is lowered, the suction shield is lifted and conveyor motor MOT1 is started and moves next workpiece.

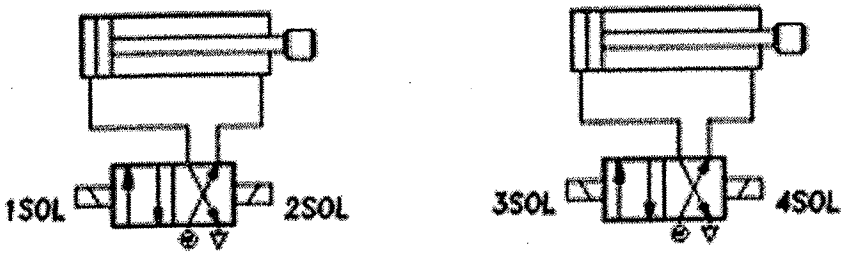

Figure 03