



Allowed Tables and Charts: None

PART (1) CONTROL OF PNEUMATIC SYSTEMS

(40 Marks)

Answer all the following Questions

Question (1)

[15 Marks]

- (a) Explain the main characteristics of the diaphragm compressors. (2 Marks)
- (b) Compare between rotary vane and liquid ring compressors. Indicate your answer with neat sketches. (4 Marks)
- (c) What does (RDC) mean in Pneumatic system? Explain (in points) with neat sketch the main idea of it. (6 Marks)
- (d) Lubricator is an urgent component in pneumatic circuit. Discuss why and where it is installed in the circuit. Explain with sketch its operation. (3 Marks)

Question (2)

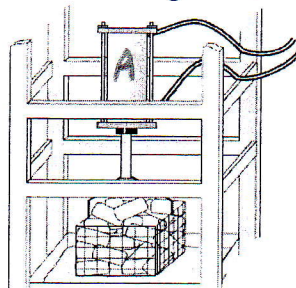
[10 Marks]

- (a) How can the actuator speed in a pneumatic system be controlled? Explain your answer with neat sketch on single acting and double acting cylinders. (5 Marks)
- (b) A delivery lorry uses a pneumatic braking system. The brakes operate when the driver presses the foot brake. Two single-acting cylinders should outstroke at the same time and press against the wheels. Build up with neat sketch a simple circuit that can be used for such purpose. (5 Marks)

Question (3)

[15 Marks]

- (a) In a section of a recycling plant, metal cans are dipped in a chemical solution to remove traces of dirt, oil and paint. In order to raise and lower a basket containing the cans, an indirect controlled double-acting cylinder (A in the figure) is to advance when a push button is operated. Upon release of the push button the cylinder is to retract. The cylinder is 250 mm in diameter and consumes a large volume of air. Design and explain (in steps) the circuit diagram for the problem. (7 Marks)



- (b) The piston rod of an indirect controlled double-acting cylinder is to advance when a 3/2-way push button valve is actuated manually. The cylinder is to remain advanced until a second valve is actuated. The signal of the second valve can only take effect after the first valve has been released. The cylinder is to then return to the initial position. The cylinder is to remain in the initial position until a new start signal is given. The speed of the cylinder is to be adjustable in both directions. Design and explain the circuit diagram for the problem. (8 Marks)

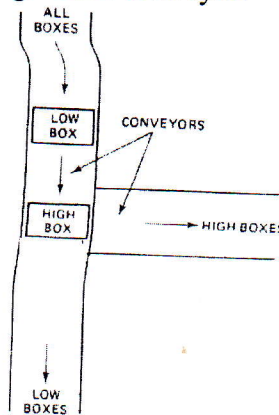
Please go to PART (2) in the next page (hydraulic systems)

Answer Two of the Following Questions

Question (4)

[10 Marks]

- (a) Draw with sketch the Moving Part Logic circuits utilizing the following logic control functions: **AND**, **OR**, **MOMERY** and **NOT** functions.
- (b) The figure shows the production line of two different-sized boxes moving on conveyor. Explain with sketch an electro-pneumatic system for sorting two different-sized boxes moving on the conveyor.



- (c) Draw with sketch the electrical control of a regenerative cylinder.

Question (5)

[10 Marks]

- (a) What are the steps of design of an electro-hydraulic motion control system? What are the measured variables in an electro-hydraulic system for control purposes?
- (b) Explain with sketch the hydraulic circuit and electrical diagram used for controlling a hydraulic cylinder using pressure switches.
- (c) Discuss with sketch the sequence circuit of two pneumatic cylinders and electrical diagram. (Cylinder 1 extends, cylinder 2 extends, both cylinders retract and cycle ended)

Question (6)

[10 Marks]

- (a) Draw and explain the difference between open and closed loop electro-hydraulic control systems. Draw the hydraulic circuit for a service truck and for an excavator.
- (b) Discuss with the aid of sketch major valve actuation methods.
- (c) Explain with sketch the principles of pressure-limiting and load sensing control using a hydro-mechanical feedback on an axial piston pump. What is the control element of the pump?

***** End of Questions *****

Best Wishes

Assoc. Professor Wageeh El-Askary & Assoc. Prof. Mohamed Abdel Aziz