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Question Paper Code : **70909**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fifth/Sixth Semester

Mechanical Engineering

ME 8694 – HYDRAULICS AND PNEUMATICS

(Common to: Manufacturing Engineering/Mechanical Engineering (Sandwich)/Robotics and Automation)

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Pascal's law.

2. Mention any six desirable properties of hydraulic oil used for industrial automation.

3. Differentiate between pressure relief valve and pressure reducing valve.

4. Illustrate the significance of a double end rod cylinder with an industrial example.

5. Compare hydraulic and pneumatic drives of automation with respect to pay load, power-to-weight ratio and speed control.

6. Sketch a synchronize circuit for a two double acting hydraulic cylinder connected in parallel.

7. Why 5/2 DCV is preferred over 4/2 DCV for pneumatics?

8. How cushioning is achieved in a double acting cylinder?

9. List the three advantages of fluid power over mechanical and electrical power.

10. State any three reasons for heat generation in hydraulic oils and suggest the remedial measures.

PART B — (5 × 13 = 65 marks)

11. (a) Illustrate the working of a vane pump with a neat sketch.

Or

(b) Explain the elements used in a hydraulic power pack with suitable sketches.

12. (a) With suitable example, explain the working of a telescopic cylinder.

Or

(b) Explain the working principle of external gear motor with a neat sketch.

13. (a) Sketch and explain the regenerative circuit. Also derive the formula for extending speed, retracting speed and speed ratio for regenerative circuit.

Or

(b) Define the role of accumulators in a hydraulic circuit along with its variants. Demonstrate its role with a real time example.

14. (a) Elaborate on the working of regulator and lubricator in a pneumatic FRL unit.

Or

(b) Design a ladder diagram for the electrical control of the regenerative circuit of a hydraulic punching machine circuit shown in Figure 1. Solenoids A and B are actuated by a manual push button. The cylinder should extend rapidly up to a certain distance and continue to extend slowly beyond that point until full extension. The cylinder should be hydraulically locked after the execution of the task.
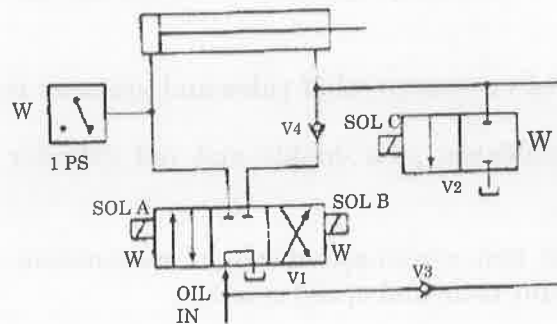
1 PS – pressure switch

Figure 1

15. (a) Design and explain the hydraulic circuit for a drilling machine to control the following functions.
    (i) Clamping the work piece.
    (ii) Drilling the work piece.
    (iii) Feed control
    (iv) Unclamping the work piece.

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(b) A container is to be turned by 180° from one plane to another as shown in Figure 2. As the container arrives, the cycle starts turning motion. Cylinder 'A' extends and turns the crate to 90°. Cylinder 'B' is in extended position and now retracts, turning the crate by another 90°. Design a pneumatic circuit for the above sequence using cascade method. The cycle has to start once 'start' button is pressed.
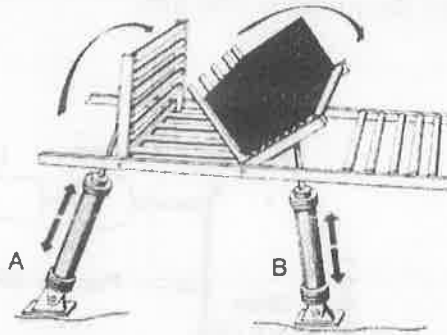

Figure 2

PART C — (1 × 15 = 15 marks)

16. (a) An automated medicine filling station is shown in Figure. 3. If a push-button is actuated, the dispensing cylinder-A extends, thereby opening the feed container and the bottle is filled with medicine. Then, it retracts, closing the feed container and the separating cylinder-B retracts and extends again immediately so that a new empty medicine bottle is located under the filling valve. Develop a ladder logic diagram for the above application.
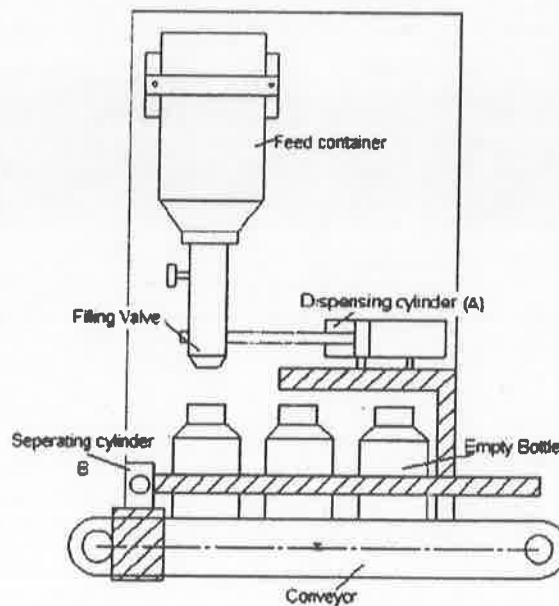

Figure 3

Or

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(b) The system shown in Figure 4 contains a hydraulic pump delivering high pressure oil of specific gravity 0.9 and kinematic viscosity $1.25 \times 10^{-4} \, m^2/s$, to a hydraulic motor. A 25 m pipe of internal diameter 30 mm and thickness of 10 mm connects the pump and motor. The pipe has two elbow fittings (k = 0.70) and one check valve (k = 4.0). The motor is placed 10 m above the pump. The pressure required to drive the loaded motor is 40 bar. Determine the pump discharge pressure, if the discharge from the pump is 180 lpm.
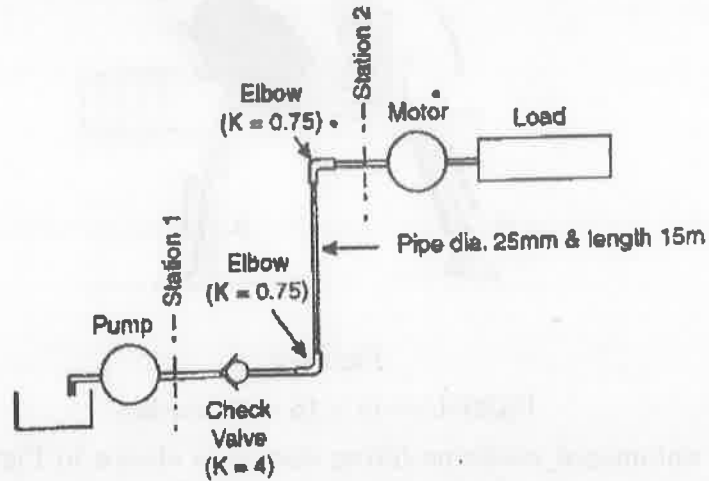

Figure 4

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